A Database Publication

THE MICRO USER

Volume 4
Number 6
August 1986
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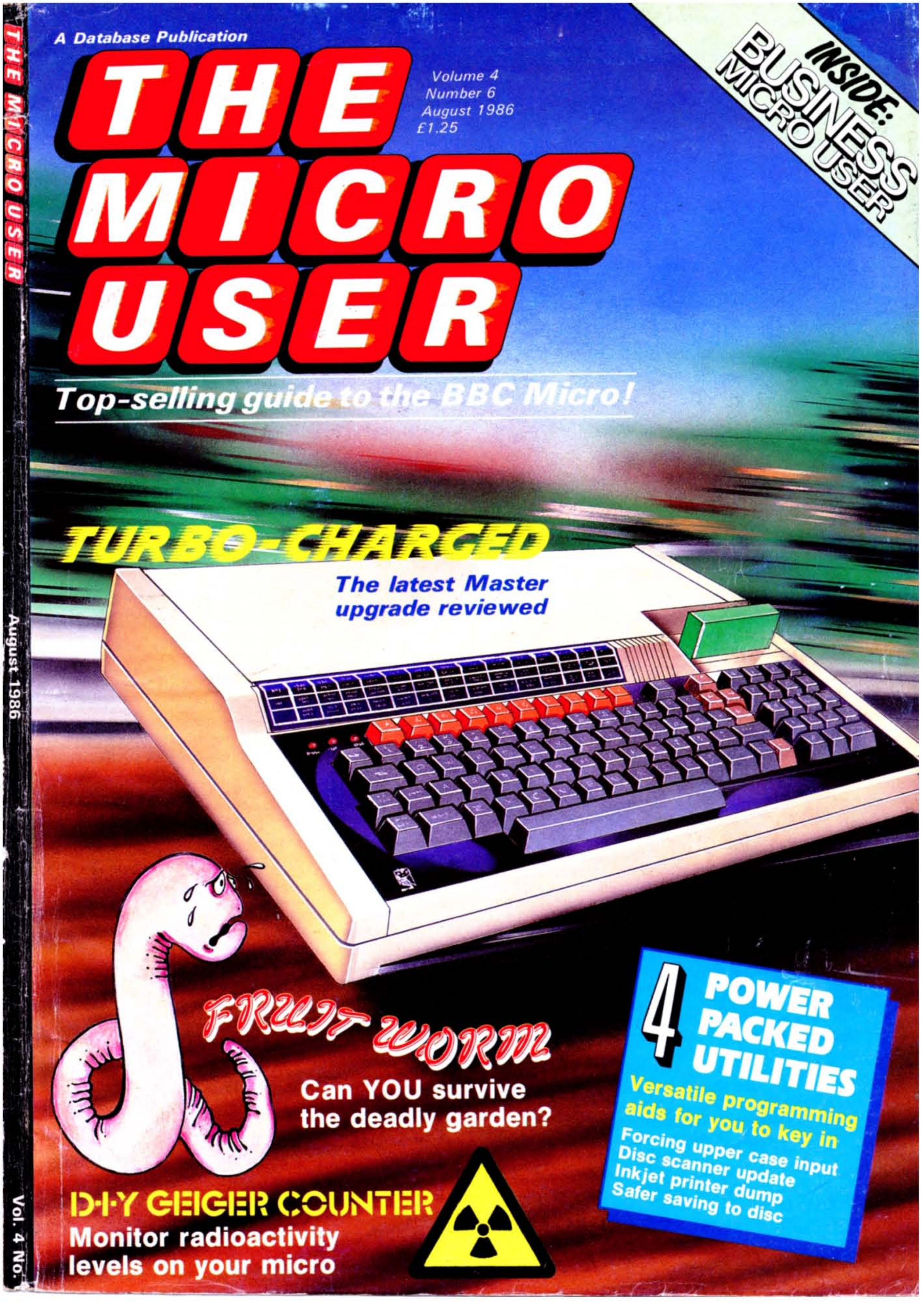
Top-selling guide to the BBC Micro!

INSIDE: BUSINESS MICRO USER



TURBO-CHARGED

The latest Master upgrade reviewed

FRUIT WORM

Can YOU survive the deadly garden?

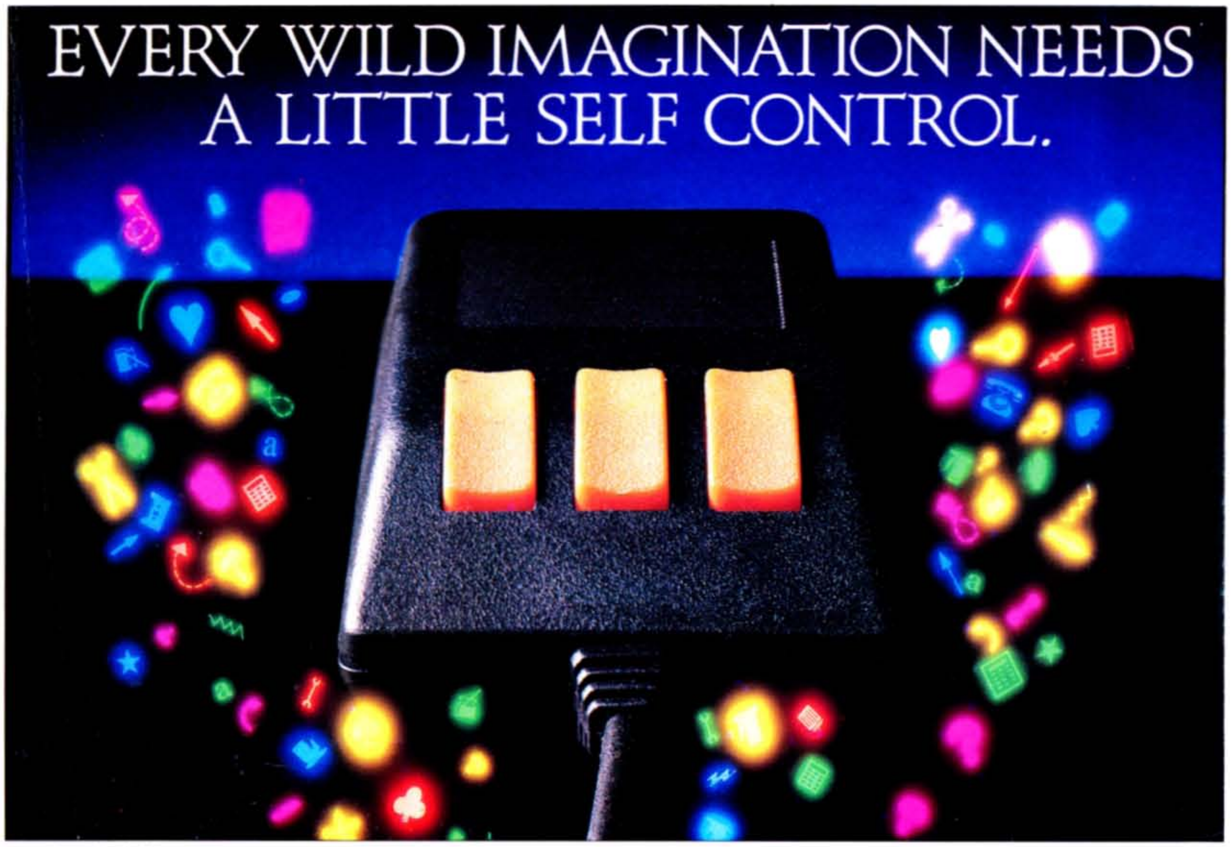
4 POWER PACKED UTILITIES

Versatile programming aids for you to key in

Forcing upper case input
Disc scanner update
Inkjet printer dump
Safer saving to disc

D-I-Y GEIGER COUNTER

Monitor radioactivity levels on your micro



As a BBC Micro user, you enjoy some pretty sophisticated equipment.

So it's a pity if you are still missing that sophisticated, positive control your equipment deserves.

There's not much joy in a joystick, and keyboards can be all fingers and thumbs. Frustrating, especially when your imagination is much faster than your fingers!

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The AMX Mouse brings to BBC Model B, B+ and Master 128 users, the same freedom and versatility which has, up to now, been the exclusive province of much more expensive computers.

In fact, it's no surprise that nearly all the new 16 bit 'State of the Art' computers now come with a Mouse as standard. Proof, if proof were needed, that the Mouse is here to stay.

The AMS range of Mouse software includes, AMX Art, AMX Utilities, AMX Pagemaker, AMX Super Art/Rom, AMX Paintpot, AMX Desk, AMX Data Base, AMX 3D Zicon, AMX XAM, and to be released in summer '86 AMX Spread Sheet.

There is also a growing list of programs available from other leading software houses, which utilize the Mouse, including, Colour Art from Watford, Mini Office II from Database, Novocad from Technomatic, Icon Master from Beebug, Compas Starter CAD system from British Thornton, CAD Soft from CAD Soft, Solidesk from Solidisk, and Mode 7 Art from Tubelink and of course View and Wordwise are also compatible, many more titles will be available soon.

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The Micro User welcomes program listings and articles for publication. Material should be typed or computer-printed, and preferably double-spaced. Program listings should be accompanied by cassette tape or disc. Please enclose a stamped, self-addressed envelope, otherwise the return of material cannot be guaranteed. Contributions accepted for publication will be on an all-rights basis.

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PLAY IT LIKE THERE'S NO TOMORROW
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A comprehensive collection of fun educational programs for the BBC micro.
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A thorough evaluation of a highly intelligent auto-dial, auto-answer modem from Tandata.

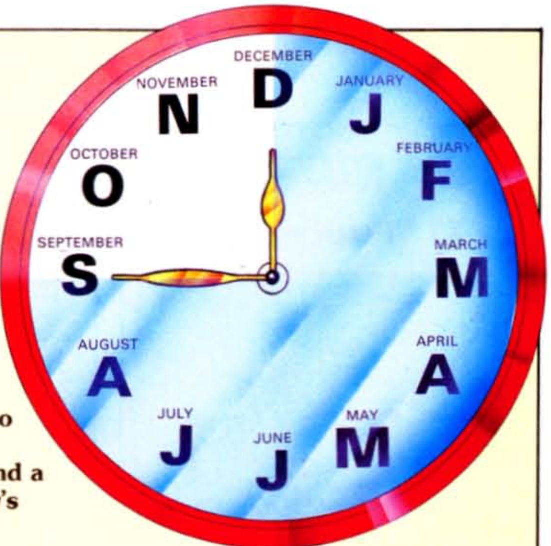
7 Application

How the BBC Micro's making life on the ocean waves easier – by helping a business design yacht sails.

13 Spreadsheets

There are two ways of copying formulae – relative and absolute – and both make constructing spreadsheets far easier.

Yes – it's bargain-hunting time again!



For BBC Micro and Electron users this is the start of the top buying period of the year – the time when they stock up with all the latest hardware and software that will enhance the versatility, power – and just sheer fun! – of their micros.

And the ideal time to hold the Electron & BBC Micro User Show, where they get the best of both worlds – a first look at all the fascinating new-season products, and a chance to pick up really worthwhile bargains as yesterday's top sellers are sold at rock-bottom prices!

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The memory limit on the BBC Micro can now definitely be a thing of the past. The new Solidisk Fourmeg 256 board offers all you could wish for.

It has 256K of extra RAM, a superfast 4MHz CMOS processor, sophisticated memory management, sockets for high capacity ROMs and 48K of software in ROM.

In fact, it contains even more devices than the BBC itself. It is compatible with most hardware add-ons — except Sideways ROM expansion, which explains why this special offer.

Fitting it is easy. You remove the existing processor from its socket and plug the new board in its place, push on three colour-coded wires, clip on two mini-hooks and it's ready. Switch on the computer and you will immediately see the difference.

The message "Solidisk 256K expansion (4MHz)" announces the new memory size and speed.

A switch at the back lets you select between the old (2MHz) and the new (4MHz) speed.

The BBC Micro at 4MHz easily surpasses the new MASTER 128K on benchmarks.

For example, it runs the benchmark using Basic 4 in only half the time taken on the MASTER 128K.

If you have too many ROMs to plug in at once, the Fourmeg 256 offers TWO ways out. First, it includes additional high capacity (and fast) ROM sockets. Moreover, two or four normal ROM images can be stored in one high capacity ROM chip (by "Vertical Paging") — so more can be made immediately available at your fingertips.

Secondly, ROM images can be stored on discs and loaded into any one of the eight Sideways RAM banks available.

If you need more room in "languages" such as VIEW or BASIC, you may use any of the eight SHADOW RAM banks. No user memory is then lost to the screen, whatever the screen mode (while machine coded programs can access RAM right up to &FC00!).

Two frequent uses of the extra memory are as a RAMDISK or a printer buffer.

Star commands in the ROM can turn the extra RAM into a silicon DISK of 200K, compatible with both the Solidisk DFS and ADFS formats. The RAMDISK is at least 10 times faster than physical disc drives as it has no moving parts.

The printer buffer saves you time, it lets you use the computer while feeding your printer in the background.

In addition, the MANAGER ROM offers over 30 star command utilities to save time and effort using the computer.

To complement such a powerful product, Solidisk has arranged with Computer Concepts to bundle the famous WORDWISE PLUS wordprocessor ROM and manuals. This excellent product, worth £45.00 on its own, became the best selling wordprocessor for the BBC computer last year.

All in all, the Solidisk Fourmeg 256 offers an unmatched combination of speed, power and built-in facilities, while still having room for even further expansion. It is the most logical next step for the owners of any Sideways ROM board or of Solidisk Sideways RAM, who can trade in their present boards for the excellent Fourmeg 256.

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Phantom Combat	Cas. £9.50 Disc £14.50
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Nightshade	Cas. £9.50
Karate Combat	Cas. £8.50 Disc £10.50
Yie Ar Kung Fu	Cas. £8.50 Disc £10.50
Hypersports	Disc £11.50
Commando	Cas. £9.50 Disc £12.50
Phantom Combat	(for 2B's) Disc £19.00
Treasure Hunt	Cas. £9.50
Rebel Plant	Cas. £9.50
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ROMS/UTILITIES

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Interword		£49.00
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Interchart	Rom	£34.00
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Communicator	Rom	£65.00
Toolkit Plus	Rom	£36.00
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Murom (Music)	Rom	£28.00
Master File II	Disc	£18.00
Help II	Rom	£29.00
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Hershey Characters	Disc	£19.00
Hershey Characters	Cassette	£11.00
Logo (LCSI)	Rom	£59.00
Replica III 40/80	Disc	£14.00
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Vine Tape to Disc	Rom	£18.00
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Wordease	2 Roms	£27.00
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Advanced User Guide Binder	£3.95
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Applied Assembly Language BBC	£7.95
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Wordwise Plus (new)	£9.95
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Creating Adventures on BBC	£5.95
Step by Step Programming BBC Book I	£5.95
Micronet Handbook	£6.95
40 Best Machine Code Routines BBC	7.95
Assembly Language Programming on BBC	£11.50
BBC Micro Advanced Reference Guide	£10.95
Advanced Disc User Guide	£14.95
Advanced Machine Code Tech for BBC	£7.95
Art of Micro Graphics BBC/Electron	£14.95
BBC Micro and the Small Business	£5.75
BBC Micro Advanced Programming	£9.95
Beginners Guide Word Processing on BBC	£6.95
Beyond Basic	£7.25
Building Blocks for BBC Games	£6.95
Guide to BBC Roms	£9.95
Mastering Assembly Code on BBC (BBC Pub)	£8.95
Mastering Music on BBC (BBC Pub)	£6.95
Mastering the Disc on BBC (BBC Pub)	£7.95
Mathematical Prog in BBC Basic	£7.95
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6502 Reference Guide	£9.95
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THE MICRO USER

NEWS

August 1986

Is Acorn to launch two new micros?

ACORN is maintaining a discreet silence over persistent reports circulating in the UK that it is to launch two new micros this year.

Company officials refuse to be drawn over claims that the final touches are being put to models aimed at opposing ends of the market.

One is rumoured to be an inexpensive computer word processor unit, the other a super powered 32 bit machine.

The cheaper micro is said to be aimed at the lucrative sector of the market currently dominated by Amstrad.

"It will be based on the BBC Micro and come complete with monitor and printer – the latter being much better than the Amstrad one – and ready to plug in", insisted a source close to the company.

"At long last Amstrad will find itself with some competition on its hands – even if Acorn has had to learn from Amstrad itself".

Meanwhile the possibility of Acorn unveiling a 32 bit machine was given a real boost with the news that the company has been instrumental in developing a super chip.

Go-ahead

Acorn has revealed that it has given an American manufacturer the go-ahead to produce the 32 bit chip based on reduced instruction set computer – RISC – technology.

Designed and developed by Acorn at Cambridge over the last three years it will now be made under licence by Arizona-based VLSI Technology.

RISC involves cutting down the number and complexity of processor instructions. The chip from Acorn is said to be the lowest priced of its type currently on the world market today.

It has just 44 basic instructions, which means it can perform with great speed. Running at four million instructions per second it is much faster than either Intel's 80286 chip or Motorola's 32 bit 68020.

"A new Acorn machine based on this chip could be a world beater", one expert told *The Micro User*.

However Acorn is simply keeping mum. "Interesting gossip", was the comment from one spokesman.

The talking Micro User in demand

PUTTING issues of *The Micro User* on audio cassette for Britain's registered blind computer owners has been "a resounding success" according to the man who runs their user group.

"The more blind people who can gain from a BBC Micro the better", says David Calderwood, chairman of the Visually Disabled User group and a blind BBC Micro user himself.

"I have been overwhelmed by enquiries about the VDU group since *The Micro User* carried articles about us and about putting the magazine on tape.

"Your series of articles on spreadsheets is of particular interest because we have a program which permits a blind user access to Inter-sheet by Computer Concepts".

Since May the magazine has been on the list of publications transcribed on to audio tape by the Talking Newspaper Association, an organisation serving Britain's registered blind and partially-sighted who cannot read ordinary print.

Each month a special cassette containing news, reviews and articles from the magazine is prepared and made available to the association's 10,000 subscribers.

"The entire index of each issue is read on the tape", says Calderwood. "Of course not all the articles are featured because a C90 cassette just isn't long enough, but if a missing article is of interest our members get a friend to buy the magazine and read it to them".

Hard disc promised

ACORN has confirmed it is bringing out a new 20Mbyte Winchester disc drive.

Andrew Hinchley, in charge of Acorn's communications products, says the stand-alone Winchester will be an "official Acorn product" rather than one claimed to be "totally Acorn compatible".

He would give no further details other than that Master owners, who already have an ADFS, will simply plug the Winchester into the 1MHz bus port.

Hinchley said: "It is unclear yet what the price will be but we expect it to be about £1,000. If we can hit that mark we hope to pick up a reasonable volume of sales.

"It is a very reliable Winchester, well tested and with after sales warranty".

Teachers working-out with the TVEI Wordwise Training Pack

Wordwise tutor

A TRAINING system for Wordwise and Wordwise Plus users which runs on the BBC Micro, BBC Plus and Master series made its debut at the July annual conference of Micro Users in Education.

The pack is written by Jacquetta Megarry and Eric Deeson with the support of Wordwise publisher Computer Concepts, and the project was funded by the Manpower Services Commission.

It helps teachers to acquire word processing skills through self-study, and is also suitable for students of all ages, home and small business users.

The TVEI Wordwise Training Pack costs £28, bundled with Wordwise £54 and with Wordwise Plus £66. It is available from Jordanhill College Publications Unit.

4088 more colours – for £99

A PROFESSIONAL 250 points per inch tablet with pen, colour card and eprom software for the BBC Micro has been released by CTS Recognition.

The Artist Plus has a colour card which provides 4096 shades, against the BBC Micro's eight colours, and costs £595.

The Artist is a similar eprom software package but comes without the colour card and uses a mouse on the BBC. It costs £99.

On its own the colour card costs £99.

'Stop this aimless waste' plea to Government

A LEADING software publisher has called for fresh government initiatives to prevent "aimless waste" of the BBC Micro in education.

Martyn Partridge, chairman of Logo Software, has written to the Secretary of State for Education and Science Kenneth Baker requesting a firmer lead from his department regarding curriculum development and computer training for teachers.

Partridge says by putting a micro in every school the government "created at a stroke a vast potential market for educational computing developments" but its potential has not been realised.

He cites three factors in support of his argument:

- Grounding of the MEP scheme in mid-flight creating a situation of uncertainty in the educational software business.
- Reports that more than two-thirds of primary schools limit teacher training to "no more that turning the micro on and running elementary programs".
- Figures showing that the proportion of university applicants opting for computer and other technology courses is falling.

Partridge says given a fair chance Logo would play a major role in delivering the government's objective of a high degree of technological skills among the British population by the next century.

"Logo makes the use of computers interesting and exciting, even to very young children, and inculcates the habits of mind associated with the abstract manipulation of quantity, space and logic", says Partridge.

"Our experience since the launch of LSL Logo in 1984 indicates problems symptomatic of the new technology initiative and its areas of failure.

"There is a general lack of concerted information, which the passing of the MEP will only exacerbate.

"Throughout the country there are numerous projects aimed at developing the use of Logo, but many of these seem to be working in ignorance of each other and duplicating each others' efforts". And he concludes: "This situation is not yet hopeless, but a change in emphasis is required.

"It is not sufficient to supply hardware, or software, in the hope that teachers throughout the country will spontaneously deploy it to good advantage.

"The solution can only be positive direction from the Department of Education and Science in the context of clearly stated objectives for teacher training and curriculum development.

"This will go a long way to recreate a climate of confidence in both education and industry".

Eureka! It's extra RAM

LEADING supplier to the BBC Micro market Watford Electronics has unveiled a new RAM expansion card called the Eureka! Card.

It provides up to 14k more RAM than a 6502 second processor gives to the Hi versions of View, Basic and Wordwise Plus. Shadow RAM is provided automatically.

"The Eureka! Card would have made Archimedes jump out of his bath twice as quickly", said Nazir Jessa, managing director of Watford Electronics.

An extra facility provided by the card is two banks of sideways RAM with one write-protectable. The socket numbers of the banks are user-programmable.

The card fits into the processor socket of the BBC Micro and is controlled by software contained within a standard sideways ROM.

It is fully buffered, not only to the on-board RAM but also to the BBC Micro as well.

A new set of Osword calls are provided with the card to allow blocks of extra RAM to be written to and read from directly.

Prospects are bright for Scottish partners

A PARTNERSHIP between Scottish industry and education, set up to market educational software for the BBC Micro throughout the world, has been formally launched.

Designed in Scotland, the software will be marketed through Scetlander Ltd, jointly owned by the Scottish Council for Educational Technology and Scotlander, one of Scotland's youngest public companies, headed by Ron Lander.

A Glasgow student demonstrates the products

The official launch was performed by Minister for Industry and Education, Allan Stewart, at the Scottish Office.

The first educational catalogue produced by the company contains details of more than 60 different software programs, catering for all ages and varying degrees of ability from pre-school to further education.

Dr Tom Bone, chairmain of SCET and principal of Jordanhill College of Education, said: "This joint effort is the secure basis for a marketing venture which SCET has been seeking for some years. The prospects are bright".

Prices of the programs range from £7.50 to £17.50 with suites of programs costing from £20 to £40. There are special rates for bulk purchases.

PHONE CONTROL BY MICRO

A COMPUTER controlled automatic telephone dialler has been devised by Wigmore for the BBC Micro and Master.

EasiCall enables you to dial calls via a large telephone directory stored in the computer.

The directory contains up to 150 names, addresses and numbers per disc on the BBC Micro and more than double that on the Master.

EasiCall plugs into the user port at one end and the phone socket at the other. The phone is then plugged into the dialler.

An auto scheduler feature permits users to stack up to 17 calls at a time which EasiCall automatically cycles through.

It has its own interface so that external sensors can be used to trigger a call.

The package costs £89.90, with an extra £10 for the Master version.

US Gold expands

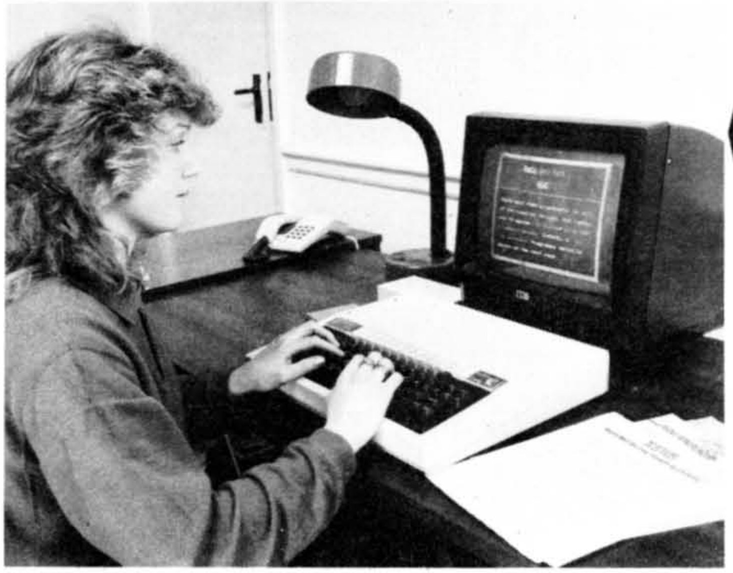
A FURTHER 50 staff are being recruited following the fourth expansion move in five years by US Gold.

Continued increases in software sales for computers, including the BBC Micro, during the last 18 months have left both US Gold and Centresoft "need much more space".

The two new units, totalling 35,000 sq ft, are on IMI's Holford industrial estate in Birmingham.

Geoff Brown, managing director of US Gold, said: "Holford compares very favourably with the best of the Californian developments or the advanced industrial estates in the South of France.

"Another advantage is its location with both companies operating a 24 hour distributing service".



A hospital secretary writing a page for Parkfax

Viewdata in hospital

PATIENTS and staff at a large Surrey hospital have their own viewdata information service controlled by a BBC Micro.

Andrew Jones, administrator of West Park Hospital in Epsom, set up Parkfax as an electronic magazine which can be viewed on television sets in wards and lounges throughout the establishment.

Like a localised version of Ceefax and Oracle, the system carries area news, bus timetables, weather forecasts and updates on hospital news both on the administrative and social sides.

Information is fed into the system by staff using a BBC Micro. It uses the Visifax software package written by Michael Bawtree and published by Woodhead - Faulkner, priced £150. This enables BBC Micro users with Basic II and a disc drive to generate their own sequence of pages for display allowing creation of up to 80 frames with 40 track drives and 180 frames with 80 track drives.

As well as supplementing the hospital's other in-house information services like the internal radio and news-sheets, the system fills an additional, more serious role.

Using a page on Parkfax it is possible to locate the exact zone in which a fire alarm has been activated and to relay this information round the hospital.

This has the effect of significantly speeding up the time of response to the raising of a fire alarm, a benefit which could save lives in an emergency.

Wordwise enhanced

WORDPRO from Softec is a "bolt-on" Wordwise Plus facility for writers who have to work with long documents.

It comprises a master 40/80 track 5¼in disc containing an on-screen user guide which generates user text file discs in one of three different styles according to work requirements.

Wordpro is primarily a suite of compressed segment programs which operate in segment 0 to leave the user as much memory space as possible for text – typically, seven A4 pages.

The resident program at any time is only concerned with current mode requirements, and if another mode is invoked a new program is automatically loaded, thus minimising disc accesses and delays.

Simple commands allow the user to move instantly around the text file without the need for scrolling.

A single command can create temporary landmarks in the text which appear emboldened on printouts. They are easily erased when editing is completed.

In conjunction with Wordwise Plus the user can spill over from one file to another on the same page, avoiding the problem of printing text which overlaps files. Price £23.

Bitstik 2 system for the Master

A VERSION of the Bitstik 2 computer aided drafting system from Robocom has been developed for the BBC Master series.

Bitstik 2 will now run on the BBC Micro, B+, Master 128 and Master Turbo. Users require dual 80 track disc drives and a 6502 second processor.

The system now includes A3/A4 plotter software compatible with all BBC models and with A1/A0 plotter software available as an optional add-on pack.

Robocom has also released 12 pre-drawn library discs consisting of standard symbols, components and lettering which Bitstik 2 users can incorporate into their drawings.

Titles available include Chemical Schematics, Analog Electronics, Digital Electronics, Fluid Power Symbols, Sketch Maps, Charying Aids and a selection of popular type faces.

Bitstik 2 costs £795, A1/A0 plotter software £95, and pre-drawn library discs £35 each. Discounts are available for educational establishments.

Video graphics pack

CREATIVE BBC Micro users will be able to practice their skills with a new publishing package by Advanced Memory Systems.

AMX Magazine Maker is a combination of AMX Pagemaker and AMX Video Digitiser.

Using any video providing a composite signal, and the digitiser, images from a camera or TV can be converted into a graphics screen.

They can be used with AMX Pagemaker to illustrate magazines or newsletters.

"It is low costing yet high on creativity", said Nick Pearson, managing director of AMS.

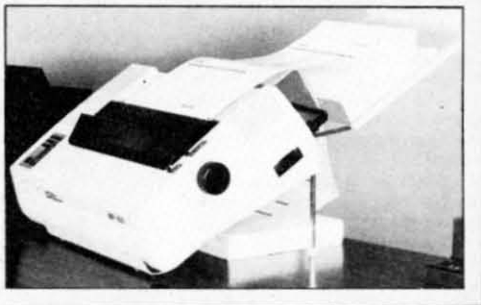
Pictures can be doctored, using Pagemaker's graphics option to produce any number of effects, and can then be printed out.

Don't get your printouts in a twist...

THIS paper management system from P.W. Engineering is said to solve many of the problems associated with the use of small desk-mounted printers. The base on which the printer rests is angled to allow the user to check the printout without having to peer over the top of the equipment.

The angled print feed tray is removeable, allowing access to the space under the printer stand for paper insertion and removal, and there is a combined cable protector and paper shield to prevent paper becoming entangled with RS232 and mains cables.

The unit is available in two sizes, for 80 column dot matrix printers, price £39.95, and daisywheel printers, price £49.95.



Part – ex is thwarted by shortage of Masters

A SHORTAGE of BBC Masters is restricting supplies of second-hand BBC Bs. The reason is that the used machine market depends on trading them in against new models.

Karen D'Arcy Comp Shop in North London summed up the position: "If we could get more Masters – say 30 to 40 a week – more customers would be able to part-exchange and so more second-hand BBC Bs would be available.

"Within two days of a second-hand BBC B coming in after a part-exchange deal it is snapped up Customers still want to stick with the BBC machines".

Karen added: "After all the recent publicity about the demand for BBC Micros sales have gone up 50 per cent and the figure would be higher if we could get hold of more Masters".

Depending on their age, condition and whether they have interfaces, BBC Micros trade for between £125 and £250 against a Master. Then the second-hand machines sell for £200 to £300 a time.

Karen recommends that when making a part exchange, extras such as ROM boards should be taken out and, if not needed, sold privately.

Upgrade for Diagram

A UTILITIES disc providing six additional features for its Diagram drawing program has been released by Pineapple Software, priced at £10.

Border allows the addition of a border consisting of any keyboard character or a continuous line around any defined area of the diagram.

Screen indents inserts screen numbers to assist in locating a given position in large diagrams.

Shifting diagrams involves horizontal and vertical shifting of the diagram to provide more space for drawing.

Small diagram allows the display of the whole diagram on the screen at one time.

Screen position arranges for the coordinates of the most recently displayed screen to be read.

Save and load areas permit any size area of a diagram up to one full screen to be saved to disc and reloaded elsewhere on the same diagram or another diagram using the same UDC set.

Dedicated

As a spinoff to Diagram, Pineapple has also produced a dedicated printed circuit board drawing program named PCB priced at £85.

It has been designed to enable any model 32k BBC Micro, plus the Master, to produce high quality artwork for the production of PCBs.

More speed and memory

A NEW release, PMS6502 second processor (PMS-E2P) planned by Permanent Memory Systems for the BBC Micro user, will give more usable RAM and even faster program actions.

It will run Prolog, Lisp, Iso-Pascal, Comal, UltraCalc and Turtle graphics with increased speed and memory.

Programs which involve graphics manipulation will show even larger speed increases as a degree of parallel processing occurs – the E2P doing the calculations while the BBC Micro tackles the graphics.

It requires no modifications and is compatible with the Plus 3 and Cumana disc interfaces.

Price: Under £100.

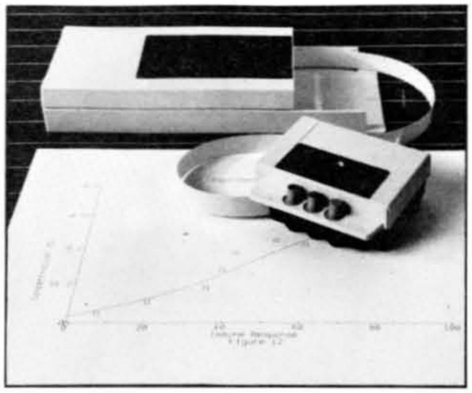
STUDIO SOUND ON TAP

A NEW software package from Proteus Computing called The Performer allows BBC Micro users to turn their computer into a recording studio.

Proteus says the program can be used by a novice but is sophisticated enough for a professional to write and record an entire album.

It allows the user to record eight tracks of music in real time, save the notes and change them as often as desired, then play back the final composition perfectly.

The software automatically makes sure the notes recorded are in time, and enables the BBC Micro to play many different Midi compatible instruments at the same time. Price: £129.95.



PLOTTING STATISTICS

PENMAN Products now has available a Data Plotting and Analysis package – DPA – for use with the BBC Micro and the Penman plotter.

Designed for use in research laboratories, schools and universities it is capable of a wide range of statistical analysis of data.

It features cross correlation, sample variance and standard deviation, and results can be graphically presented in full colour prior to using the Penman to plot out the results.

The DPA software can also be configured to work with most dot-matrix printers.

The cost of the package is £45, or £319 for the DPA complete with the Penman plotter and the BBC Micro connecting cable.

WATFORD SETS UP ITS A DEALER NETWORK

MAIL order supplier to the BBC Micro market, Watford Electronics is to break new ground by setting up a dealer network.

Watford's managing director Nazir Jessa said: "There are a lot of people who don't like to buy via mail order and who would gladly pay a little extra if only they could go to a local dealer".

The decision means that the company's hardware, software and peripherals will be available from selected dealers.

Nazir said: "Thanks to the BBC Micro our multi-million pound sales graph is still climbing, with sales already well ahead of target.

"The only other machine that sold in any significant numbers in 1985, excluding the IBM PC, was the Amstrad PCW8256".

Nazir added: "As there is a very limited market for 8256 peripherals the third party support for this machine is very small.

"It is a dedicated word processor and hence very few companies are supporting it.

"The BBC Micro on the other hand has a lot of potential still unexplored, with the education market alone worth some £25 million".

Sophisticated programming and debugging on ROM

RAMROD, said to be the first ROM compatible with the entire BBC range and 6502 second processor, has been launched by Clares Micro Supplies.

It has 52 commands in four sections – Disc, General, ROM and Tube – and has been written to work in conjunction with Clare's other recent release, Brom Plus.

With the two ROMs installed, Clares says programmers have the most sophisticated programming and debugging environment available.

Ramrod has been designed to provide access to as many parts of the BBC Micro as possible, including the shadow RAM, sideways RAM, input/output processor and second processor.

A special feature is its ability to switch immediately between the RAM/ROM banks by using Control and cursor keys, and back and forth between the memory and editor display and a disassembly of that area of memory. The MDISS command will work on a dynamic memory area.

Ramrod costs £40 on ROM and £35 on disc.

Upgrade follows Master score

ALL BBC Master series computers shipped before June are to be modified because the battery which maintains the clock and configuration is a potential fire hazard.

The move follows a scare when a BBC Master installed at a hospital in East Anglia burst into flames. The problem occurs when the lithium battery supplied with early models nears the end of its life.

Reverse charging can occur, causing the battery to overheat, leak or burst open, and in some cases ignite.

Acorn is supplying its dealers with upgrade kits – in effect a replacement battery of another type – which Master owners can have fitted, or fit themselves, without charge.

An Acorn spokeswoman told *The Micro User:* "We have an unremitting obligation to our customers to ensure that equipment is safe.

"There was an incident at a hospital in King's Lynn involving a BBC Master when there was a short burst of flame which was very quickly extinguished.

"We responded immediately by taking the machine to be tested by the Electrical Research Association, and as a result of their finding we are acting as swiftly as possible to rectify the problem.

"The hospital incident is the only one of its type reported to us, but we have decided to issue free replacement batteries for all Masters shipped up to the end of May. Machines issued after that date have been modified.

Malfunction

A leading computer technician told *The Micro User:* "When the lithium battery runs down the current drops to a low level.

"When the computer is switched on the battery has less current than that supplied to the machine from the mains and you get reverse polarity.

"The battery heats up, oozes or bursts and can catch fire quite easily".

Acorn said the danger signs – indicating battery malfunction – include loss of configuration when the machine is switched on, loss of the real-time clock, leaking battery and "strange behaviour of the machine".

"As an interim precautionary measure while waiting for the replacement kit we recommend that users switch their Master off when it is not in use", Acorn said.

Instant language learning

A SYSTEM enabling business people to communicate in foreign languages is available from Primrose Publishing for the BBC Micros.

Tick-Tack, short for Tomorrows Instant Correspondence Kit, makes it possible to write letters without linguistic skills.

The extensive databank of day-to-day sentences – each with a code number – would allow a Chinese to write letters in Russian, Spanish, English or Arabic.

It is available in the form of language books that can be bought individually in any of 24 languages, as an audio cassette or as computer software.

Text editor

Latest addition to the range is Tick-Tack Writer, a text-editor specially designed for language work.

Single language micro packs cost £150, with extra languages £75, a four-language micro pack £295 and Tick-Tack Writer £95.

Tick-Tack, has already been demonstrated at major exhibitions in Moscow, Poznan, Peking, Barcelona and Vienna.

Primrose Publishing's managing director David Sephton said a big interest was taken in the latest demonstration program which can bring up 14,000 different Chinese characters on to the screen.

The company is hoping to release a program for general sale covering the Korean character-language in September. One is also being planned for Welsh students.

Board for assembly programs

THE new DMS 68000 board from Delcomm Microcomputer Systems connects to the BBC Micro as a second processor, allowing the user to write, execute and study 68000 assembly language programs.

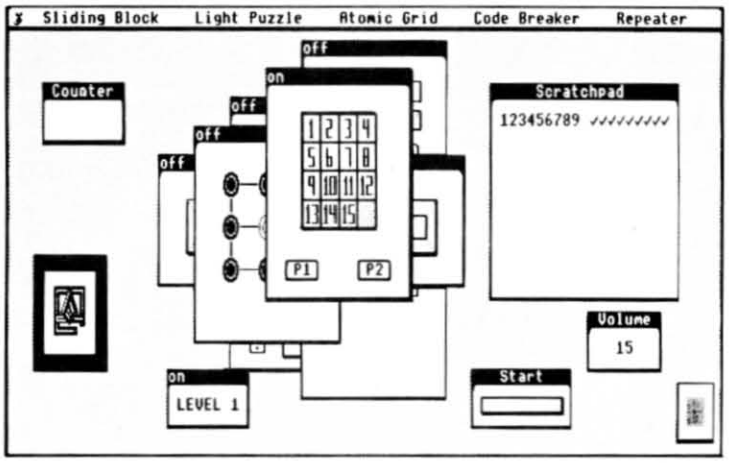
The system monitor contains facilities like load and execute programs, memory examine, memory dump, alter 68000 register, load BBC Micro memory to and from the 68000, and BBC Micro osbyte calls.

The DMS 68000 monitor allows the user to step the program. The trace will print a full register dump after each instruction, enabling 68000 machine code programs to be corrected quickly.

The board has a DIN 41612 Eurocard connector fitted with all the data, address and control lines for the 68000 should expansion be required.

All normal BBC Micro peripheral devices such as printer, discs, analog port, user port can be driven.

The package, designed for the educational and professional markets, includes a full description of the 68000 system calls which can be implemented in a similar way to the BBC's osbyte calls. It costs £299.



Playing with mice

ADVANCED Memory Sytems has launched itself into the BBC Micro games market for the first time with a breakthrough in programming.

What makes AMX Zap Zone and AMX Mind Games unique is that they are both mouse-compatible.

Not that this course of action is totally unexpected from the company that is best known for its critically acclaimed AMX Mouse package.

"We feel that making games mouse-compatible is adding yet another dimension", says managing director Nick Pearson. "And it is one that is naturally very close to our hearts".

AMX Mind Games combines five intelligence-testing games:Sliding Block and Light Puzzle test perception, Atomic Grid and Code Breaker assess logic and intuition while Repeater is a challenging memory game. The package costs £14.95 on disc.

With sound and full-colour graphics Zap Zone is a full-blooded, action packed game for the zapper enthusiasts, costing £4.95 on cassette.

Software for schools

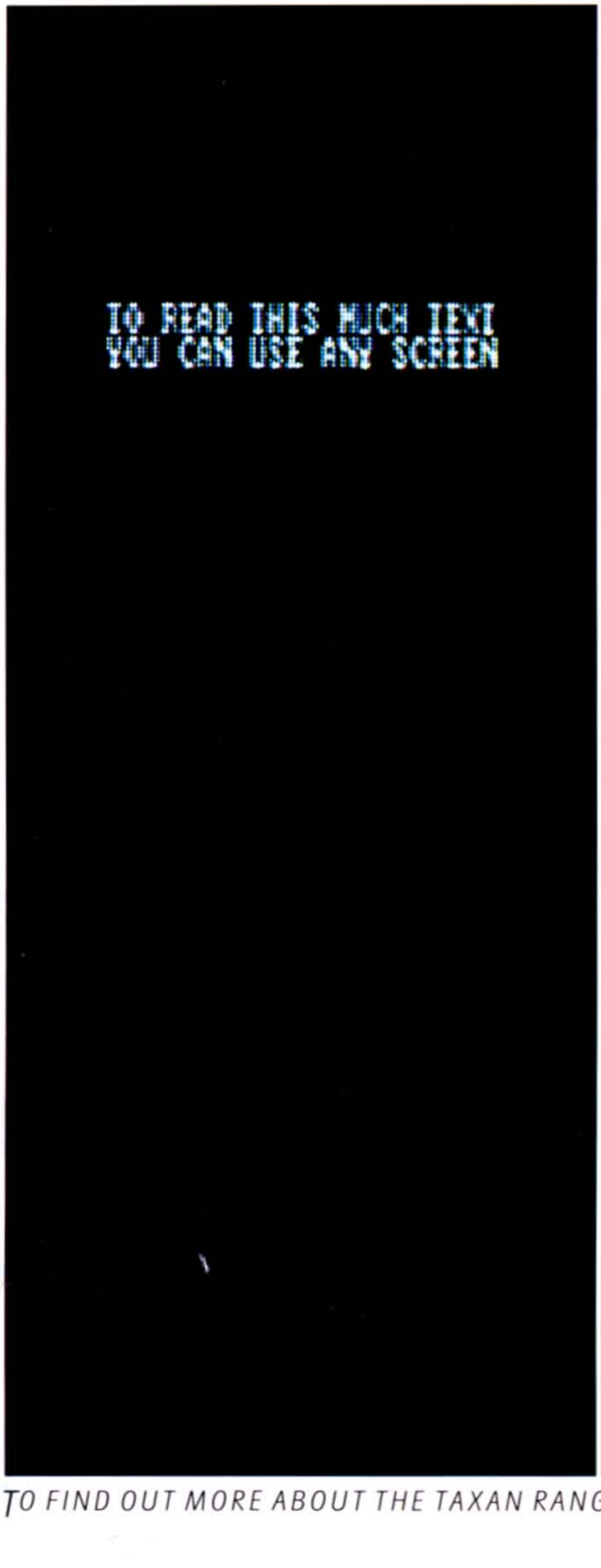
NEW style educational games have been released by Sherston Software for the BBC Micro.

In the Wizard's Return (£16) schoolchildren users have to solve a series of mathematical challenges to save the Dragon King from an underwater prison.

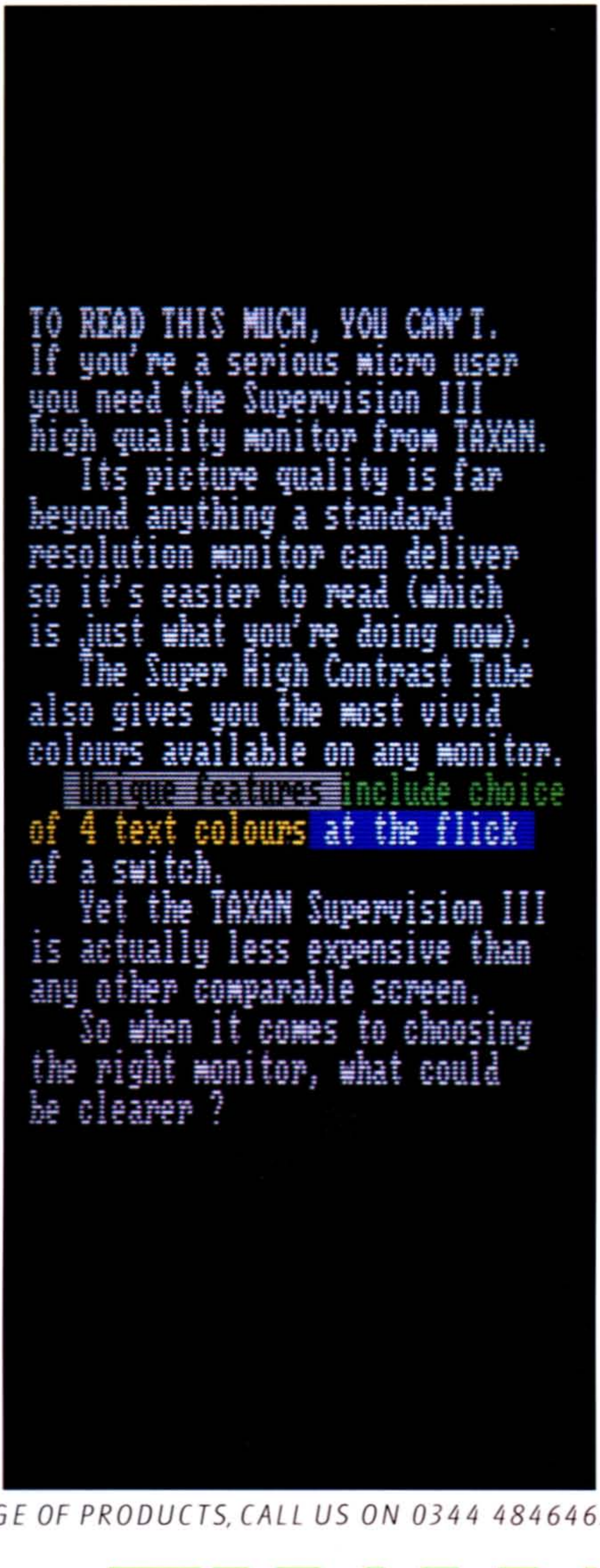
With the Graph Builder (£11.50), written by a primary school headteacher, answering a series of questions constructs graphs, which can be saved and also dumped to most dot matrix printers.

Musical education is provided with Jolly Jack Tar (£12) for juniors. It has six different games which help pupils to learn, and understand, the basic aspects of music – rhythm and pitch.

In addition to the games, the programs include demonstrations where appropriate. There is an extensive teacher control menu that allows full adjustment of the program. Points can be scored in all three games.



TO READ THIS MUCH TEXT
YOU CAN USE ANY SCREEN



TO READ THIS MUCH, YOU CAN'T.
If you're a serious micro user you need the Supervision III high quality monitor from TAXAN.

Its picture quality is far beyond anything a standard resolution monitor can deliver so it's easier to read (which is just what you're doing now).

The Super High Contrast Tube also gives you the most vivid colours available on any monitor.

Unique features include choice of 4 text colours at the flick of a switch.

Yet the TAXAN Supervision III is actually less expensive than any other comparable screen.

So when it comes to choosing the right monitor, what could be clearer ?

TO FIND OUT MORE ABOUT THE TAXAN RANGE OF PRODUCTS, CALL US ON 0344 484646.

TAXAN
A KAGA COMPANY
PERFECTING THE IMAGE

Pupils plane program takes off

SCHOOLBOYS are designing their own model aircraft with the aid of the BBC Micro.

Teachers Ian Cameron and Steve Walker had backing from Dudley Metropolitan Borough Council for their software release for schools, Plane Designer.

Already the program, published by Dudley Education Authority, has taken off in hundreds of schools.

It involved six months work by Ian, a teacher with the remedial service at Dudley, and Steve Walker, head of craft, design and technology at Great Barr School, Birmingham.

Ian said: "We were working on a project and as my interest has always been model planes Steve and I decided on a plane design.

"We tried the finished program out at a number of schools and eventually the council backed our idea, with the two of us receiving a percentage of the sales. It really has taken off very well."

The program introduces computers to the craft, design and technology areas of secondary, primary and special schools.

It allows children to design their own gliders, stores the design on disc and produces plans ready for the glider to be cut out of balsa wood, cardboard or other suitable material.

Ian said: "The children have even made their own launchers, some by catapult, and the time and distance flown by each glider is noted. From this comes an interest in maths as well as improving designs for better performances".

The program has room for records of all work done.

PD1 for primary schools costs £19.95, PD2, an advance version, costs £24.95 and NPD2, which runs on school networks, is £28.95.

Teacher Ian Cameron and pupils Mark Newey, Paul Spruce and Timothy Bakewell are flying high after the success of their program

Smart modem breakthrough

A RANGE of intelligent data modems, Series Four, has been released for the BBC Micro by Pace Micro Technology.

The range is designed to cater for medium and high speed data transmission at 1200 baud and 2400 baud full duplex. All models include V21/V23 as standard for use with 300/300 and 1200/75 split baud rates.

The basic model 2123S (V21/23) is offered without the high speed options, but it can easily be upgraded to include the higher speed capabilities of the 1200S (V22) and 2400S (V22bis) models.

Pace's joint managing director, Barry Rubery said: "We discussed the project extensively with end users, communication software writers and of course dealers themselves. The result is what we consider the ultimate modem.

"It is the intelligence in the modem software which brings meaning to the term 'smart modem'. We feel we have achieved a great step forward in the micro industry with this new range".

One of the features of the range is a 32 character LCD allowing the display of status information such as real and elapsed time from the Series Four in-built calendar clocks.

It can also display the S registers, and up to 64 telephone numbers of services which can be stored within the modem software.

A printer port has been included.

The model 2123S costs £239, the 1200S £449 and the 2400S £595.

Accounts series is extended

THE Beta-Accounts series for the BBC Micro from Clares Micro Supplies has been extended with two new releases – Statement and Stock Control.

They form part of the integrated accounting suite which is compatible with Clares' Beta-Base database.

Price of the new modules is £25 each.

Chance to play the saviour

A NEW game released by ASL for the BBC Micro, Psycastria, casts the player as the saviour of humanity.

The aim is to take over the body of famous flyer Commander Boggleswick and undo the evil caused by battling the mothership that is planning the destruction of the earth. It is priced at £7.95.

ASL has also announced it will shortly be releasing a BBC Micro version of its Graham Gooch Test Cricket.

Interface fills controller gap

FACED with the need for a type of BBC Micro interface which didn't exist, a Cambridgeshire electronics firm designed its own, and now it is offering the device to others.

Leewood Developments produced the Incremental Encoder Interface as a direct result of not being able to find such a unit anywhere in the technical marketplace.

The device is used with the BBC Micro to enable standard rotary or linear incremental encoder pulses in TTL form to be converted into meaningful decimal numbers representing the number of pulses and their position.

The interface is connected to the 1MHz bus socket of the micro and the distance travelled in pulses can be read to the screen with only four lines of Basic code.

For screen display and decision making based on encoder positions, a short program written in Basic scans the two encoders every 60 milliseconds, or in machine code every 1½ milliseconds.

Sample programs written in Basic are supplied from with the unit, and machine code software for controlling two motor driven axes with encoder feedback can be supplied from £100 depending on the type of application.

The interface costs from £250 depending on the number of encoders required.

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BBC MICROS: B, B+, Master
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At last, speech synthesis at a price you can afford. SPEECH! works entirely in software taking up less than 9K of RAM: no extra hardware whatsoever is required. Unlike other systems, SPEECH! has an unlimited vocabulary: it will say anything you want it to, and is simplicity itself to use. Simply type in: ***SAY I AM A TALKING COMPUTER, AS EASY TO USE AS 1 2 3...*** and the computer speaks.

SPEECH! has a built-in parser which translates English words into "phonemes", or speech particles. There are 49 phonemes and 8 different pitch settings which can be used directly by the *SPEAK command (e.g. *SPEAK/HEH4LOW4) so stress or intonation can easily be added wherever desired. You can change the overall pitch with the *PITCH command.

Every copy of SPEECH! comes complete with extra software:
DEMO — shows off all the features,
SPELL — an innovative educational program,
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"... incredibly easy to use. The end result is as good as anything I've heard this side of the Amiga." ... POPULAR COMPUTING WEEKLY

"Overall an excellent package" ... MICRONET 800.

"This is one utility which cannot be beaten on quality or price" ... The MICRO USER.

"SPEECH! from Superior Software is a truly remarkable offering. A rare gem indeed. Superior Software has produced a price breakthrough by achieving an apparent technical impossibility." ... A & B COMPUTING.

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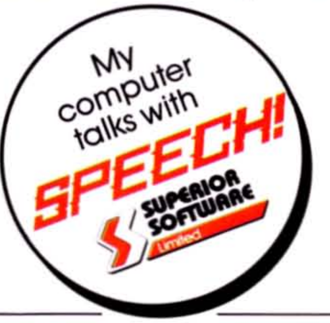
“Overall an excellent package.

Value for Money	5
Presentation	5
Use of Machine	5
Ease of Use	4
Facilities	5
Effectiveness	4

Total Score out of 30: 28”
MICRONET 800, December 1985

“Superior Software's SPEECH! is a quite remarkable piece of programming. .... The program takes up 7½ K of program space and is incredibly easy to use. It merely requires a new command word which is SAY preceded by a *. ... The end result is as good as anything I've heard this side of the Amiga and it'll make a stab at even the most ludicrous words constructed without vowels and at great length. ... It is possible to add words to the computer dictionary where they are not said exactly as they would be, using phoneme analysis and also to vary the pitch of the spoken voice. ... Why pay more?”
Popular Computing Weekly, 19-25 December 1985.


My computer talks with SPEECH!
SUPERIOR SOFTWARE
Limited

“The reproduction is suprisingly good and certainly on a par with some of the more expensive speech interfaces I have heard. All in all, an excellent low cost speech system that really is very good value for money.”
Bruce Smith, Acorn User, February 1986.

“SPEECH! from Superior Software is a truly remarkable offering. A rare gem indeed among the morass of mediocre to competent efforts which dominate a reviewer's postbag. In my view SPEECH! is an absolute breakthrough for the BBC micro which deserves to sell by the thousand. ... Superior Software has produced a price breakthrough by achieving an apparent technical impossibility. David Hoskins, the programmer, has cleverly programmed the sound chip to do things which its designers never intended it to do. ... A most practical application example also provided is a spelling checker. This has always been a problem case for educational software — how to test spellings without printing the word and revealing all. ... This program is well designed and effective and users are encouraged to customise it with their own examples. In short, SPEECH! is a very clever and useful program being offered at a silly price. If you were planning to buy another arcade game, take my advice and spend the money on SPEECH! instead.”
Jonathan Evans, A & B Computing, March 1986.

“SPEECH! is the most talked-about package ever created for the BBC Micro. For the first time it endows your micro with the power of speech for an incredibly low price.”
Christopher Payne, The Micro User, April 1986.

“If I were a manufacturer of a speech synthesis product I would be greatly worried by the arrival of SPEECH! This is one utility that cannot be beaten on quality or price.

SOUND	9
GRAPHICS	n/a
EASE OF USE	9
VALUE FOR MONEY	9
OVERALL	9

James Riddell, The Micro User, June 1986”

COMPETITION COMPETITION COMPETITION COMPETITION

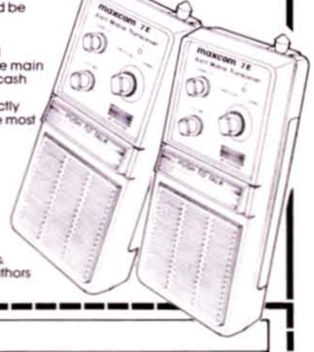
THE QUIZ

1. In which year did Superior Software release their first software cassette?
2. Can a computer be manufactured without using integrated circuits or transistors?
3. Which U.K. company manufactured the coin-operated arcade machine of the successful game Hunchback?
4. Name the author of Superior Software's SPEECH! program?
5. What was the name of the acclaimed home computer sold by Commodore before they produced the Commodore-64?
6. Which Superior Software game won the "Computer Gamer" Game of the Year Award for the Best BBC Game of 1985?
7. Name the Managing Director of Amstrad Consumer Electronics PLC?
8. Which of the following is not a valid phoneme representation as used in Superior Software's SPEECH!
EE UH C M NX ZH
9. What does the acronym ASCII stand for?
10. How do you spell the word "azure" phonetically in order to be pronounced correctly by the *SPEAK command of Superior Software's SPEECH! program?

Describe the most useful application of SPEECH! that you can envisage. (Please write your description on a separate sheet using more than 50 words, but not more than 200 words).

HOW TO ENTER
To enter, simply complete the 10-question quiz (on the left), and describe what you think is the most useful application for SPEECH! The completed entry form should be sent to Superior Software at the address given below.

THE PRIZES
Each entrant who answers the 10 question quiz correctly will receive a colourful SPEECH! badge (pictured left). All correct entrants will then be considered for the main prize of a pair of professional walkie-talkies (valued at **£200),** a trophy, and the cash prize of **£100.** The winner of this prize will be determined at the close of the competition on 31st January, 1987. The winner will be the person who has correctly completed the 10 question quiz and, in the opinion of the judges, describes the most useful application of Superior Software's SPEECH! program.



RULES
1. All entries must be accompanied by a completed entry form and a description (on a separate sheet) of what, in your opinion, is the most useful application of SPEECH!
2. All entries must clearly show the sender's name, address and age (if under 18), and should be addressed to: "SPEECH! Competition", Superior Software Ltd, Regent House, Skinner Lane, Leeds LS7 1AX.
3. The closing date for receiving entries to the competition is 31st January 1987.
4. The company's decision is final and no correspondence can be entered into.
5. The competition is not open to the employees of Superior Software Ltd, the authors of SPEECH! their agents or their families.

1		6	
2		7	
3		8	
4		9	
5		10	

Name ______________________ Age (if under 18) __________

Address ______________________

____

Telephone __________

MASTER CLASS

Part Three

Your Master made faster

By RORY McCLOY

I CAN now boast a fast 192k machine, thanks to the long-awaited arrival of the Turbo upgrade for my Master 128. In the same delivery as the Turbo were my user ROM cartridges.

The cartridges fit in the two slots behind the numeric keypad – see Figure I – and each holds two ROMS or eproms. Despite the message from Acorn on the label of the cartridge – Figure II – they do accept 8k 2764 eproms as we were led to expect, as well as 27128 (16k), 27512 (64k) and 27256 (128k) but not 27512.

The two eproms in a single cartridge can be different types. They are fitted into LEF sockets – Low Extraction Force sockets – through two windows in the back of the cartridge. The notch in the chip should be towards the open connector side of the cartridge for insertion. It requires a firm push.

Certainly if you can insert an appropriate sized screwdriver into the correct part of the LEF extraction does require less force. With the computer off you push the cartridge into the rear slot for ROM positions 0 and 1, or the front slot for ROM positions 2 and 3 – once again not the most obvious logic.

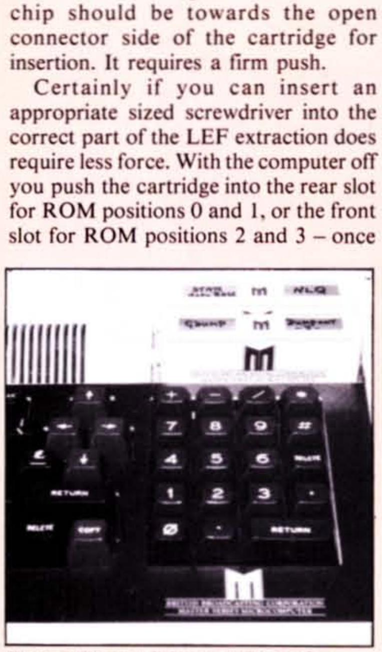


Figure I: Two user ROM cartridges in place

The ROM cartridges are a close fit through the slots in the casing and eproms tend to vary slightly in the thickness of the chip's moulding.

Two of mine were just thick enough to prevent the ROM cartridge from seating properly into its connector on the main circuit board, and I had to use a screwdriver to ease it past the hinged flap covering the slot.

It is a relief to be able to use my 8k eproms from Watford, such as Dumpout 3 and the NLQ Designer ROM which would not run in RAM without a write-project switch.

Judging from my colleagues' comments based on statements from official dealers, and both the letter from B. Townsend and the editorial reply in the June 1986 Micromail, there is still considerable confusion as to which ROMs and how many can be used in the Master 128, and whether it affects the amount of RAM available.

The first article in this series described the Master's ROM/RAM options in detail. The facts can be summarised as follows:

- The maximum number of additional ROMs that can be fitted in the Master is seven – three to internal sockets and four in the two ROM cartridges.
- Using ROM positions 0, 1, 2 and 3 in the ROM cartridges does not affect available RAM. Only the cartridges can accommodate 8k 2764 eproms.
- Only one internal ROM socket – position 8, the middle one – is permanently configured to accept ROMs. These must be 16k (27128) or larger. Use of this socket does not reduce available RAM.
- The two remaining internal ROM sockets, positions 7 and 5, can be configured to accept 16k or greater ROMs by changing links 19 and 18.

If this is done you lose 32k of RAM for each socket reconfigured. Thus ROMs fitted to positions 7 and 5 mean you lose all 64k (4 x 16k) of internal RAM – so you have a Master 64 instead of the Master 128 you started out with.

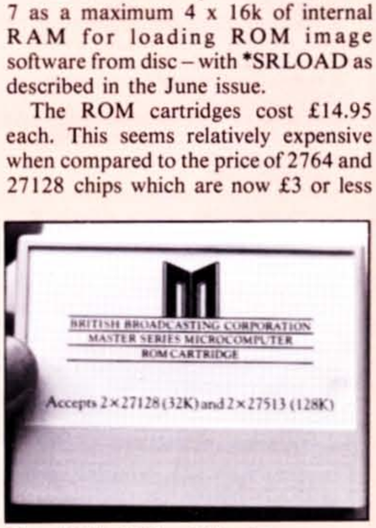
- ROM positions 6 and 4 do not exist in the physical sense as sockets you can plug ROMs into, but are two 16k RAM areas. Their availability is controlled by links 19 and 18. So if ROMs are used in positions 7 and 5 positions 6 and 4 can no longer be accessed.

My own solution is to use the ROM cartridges for those 8k and "protected" eproms that will not function in RAM.

The middle internal ROM socket, position 8, is reserved for my most useful ROM which I am unlikely to change frequently – at the moment this is Advanced Disc Toolkit (ADT) ROM.

This leaves ROM positions 4,5,6 and 7 as a maximum 4 x 16k of internal RAM for loading ROM image software from disc – with *SRLOAD as described in the June issue.

The ROM cartridges cost £14.95 each. This seems relatively expensive when compared to the price of 2764 and 27128 chips which are now £3 or less


BRITISH BROADCASTING CORPORATION
MASTER SERIES MICROCOMPUTER
ROM CARTRIDGE
Accepts 2×27128 (32K) and 2×27513 (128K)
Figure II: The ROM cartridge also accepts 2764 (8k) eproms

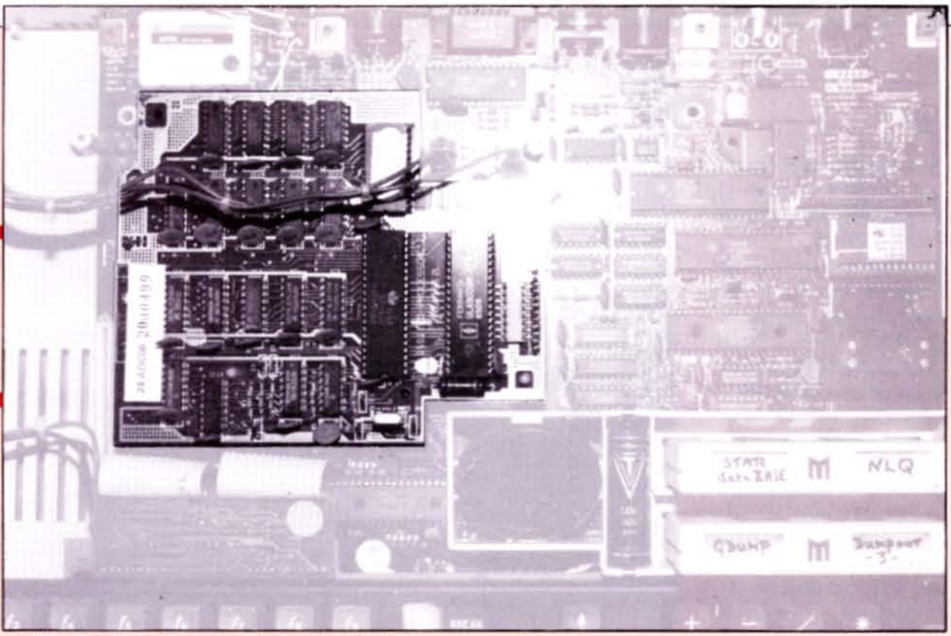


Figure III: The 65C102 co-processor board fitted

and the Viglen cartridges at about £6 for two.

On the other hand Acorn has you snookered since there is no other way of plugging ROMs into positions 0 to 3 with two cartridges. Other manufacturers must be trying to see if they can produce alternatives which avoid the patents.

Now for a real boost – the 65C102 co-processor. As soon as the Master series was announced I knew that this Turbo upgrade was exactly what I needed. I am not into CP/M or business software, whereby I might gain from the 512 upgrade, but require extra memory and speed.

Interestingly there is no mention anywhere in the co-processor package of the word Turbo and the box is simply labelled ADC06. The package consists of the board itself which has 64k of extra memory and the 65C102 second processor – altogether a surprising number of chips.

There is also a straightforward 13 page instruction manual, but I felt it could have said more about the co-processor. A DFS-formatted 40 track support disc, containing the three programs Buffer, Hi-basic and HI-edit completes the package.

It was a simple matter to fit four support legs and plug the co-processor board on to the main circuit board as in Figure III. To switch on the co-processor you need to *CONFIGURE the start-up options of the CMOS RAM to recognise the presence of the new board. Type:

```
*CO. INTUBE
*CO. TUBE
```

You should then be greeted by a message similar to:

```
Acorn TUBE 65C102 Co-Processor
Acorn ADFS
BASIC
>
```

To switch it off you need a *CONFIGURE command again, so type:

```
*CO. NOTUBE
```

(and then press Break). Of course the battery backed-up CMOS RAM will remember which state the computer was in – TUBE or NOTUBE – when you next switch on.

You only need to use the command *CO.INTUBE when you first fit the board. After a *CO.NOTUBE command the co-processor is switched back on by *CO.TUBE followed by Break.

That's it. It all seemed too easy and rather an anti-climax. Everything worked as normal, but the experts tell me that I now have one of the fastest 8 bit micros – as fast as many 16 bit machines – on the market.

The 65C102 co-processor runs at 4 MHz compared with 2 MHz of the 65C12 micro processor on the motherboard. The external 65C02 Second Processor which was available for the Model B, and can be attached to the 1 MHz Bus of the Master, only runs at 3MHz.

Rerunning the graphics demonstration programs on the Master Welcome disc soon provided obvious evidence of the 100 percent increase in speed from the co-processor board. Type:

```
PRINT ~PAGE
```

and find out that PAGE is now set at a remarkable &800 for all filing systems. This is a gain in usable memory – without recall to Hi-Basic – of six pages, or 1536 bytes, just as I was getting used to the advantages of having PAGE down to &E00.

I am sure our editor will soon publish erudite articles on the technical aspects of the 65C102 co-processor, and if I were a real pundit I would present you with the results of some benchmarks to document the increased performance. Instead as a simple-minded user I just entered View:

```
VIEW
Bytes free 48326
Editing No File
Screen mode 3
=>
```

This compared with 28926 bytes free

→

From Page 21

with my standard Master 128, and I have long-since forgotten how I managed in View with 9726 bytes free in Mode 3 on my old Model B.

The support disc provided an unexpected and superb bonus for my word processing in the form of BUFFER. To start with I was concerned with how to read the 40 track support disc on my 80 track drives – with no switches.

A small message on the disc label stated, "If you have an 80 track disc drive type *DRIVE 0 40 (RETURN) before use".

To my complete surprise, because there is no mention of this in the Welcome manual, you can post-fix the *DRIVE n command – n=drive number – with 40 to set the disc drive in a double stepping mode to read alternate tracks and so 40 track discs.

It's amazing what you learn by serendipity. I used to have this software facility on my Model B by using the *FX110, drive, 255 command with a Watford DFS, but I didn't know Acorn had introduced a similar facility on the Master. You reset the disc drive to 80 track with *DRIVE n 80.

By typing *BUFFER you run a utility which creates a 24k printer buffer on the main circuit board. The technically minded will be able to see how this works from the memory maps of the Master and co-processor boards – Figure IV.

When you are using the co-processor the current language is transferred down the Tube to the co-processor memory board, and user memory also resides on the board.

The Master mother board is left to function as an input/output (I/O) processor looking after all the peripheral activities such as running the screen, disc drive, printer and so on.

BUFFER allows you to dump in excess of 4,000 words of text into the old user memory area of the mother board within a few seconds. It will then be output to your printer, either serial or parallel, at a rate limited by the printing speed.

This is most useful, since printing a long document on a daisywheel printer or even on a dot matrix machine in NLQ mode can often take 15 minutes or more.

With the buffer in action you can safely go back to word processing – not always possible with other commercially available buffer options – or other computing tasks as soon as the prompt cursor reappears, providing you don't press Break or switch the computer off.

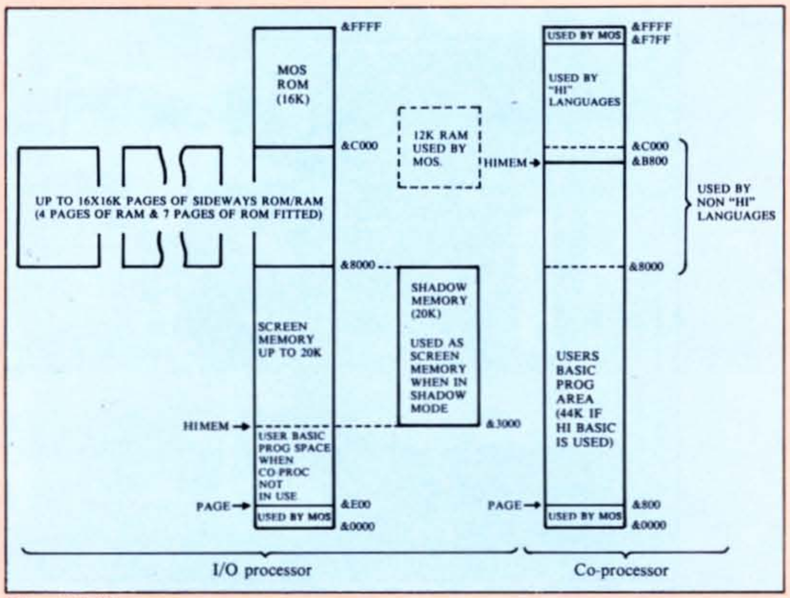


Figure IV: The system memory map

The file BUFFER is now on all my View file discs and is auto-booted when I start a word processing session as my !BOOT file contains the command *BUFFER.

If you attempt to use View and BUFFER with the co-processor switched off you will get the error statement 'not enough memory' when you try to load a text file, since BUFFER resides in the user-memory on the main circuit board.

The memory map for the co-processor shows the area between &B800-&F7FF for high languages. View 3.0, resident in the Master, is a high version and automatically relocates via the Tube to this area if the co-processor is on.

Similar memory gains to that obtained with View are available to Basic and Editor users by running the other two language programs Hi-Basic and Hi-Edit on the co-processor support disc.

Hi-Basic allows you 44k for programs and a similar increase in the memory capacity for programs in the Editor – I will be mentioning more about the advanced features of the Editor next month.

If you are not using graphics and, in particular, fill routines as seen on the Welcome disc, the doubled processing speed is not that apparent.

However, I used to find that the longer the text file in View the slower formatting and text manipulative procedures became. With the co-processor on this is no longer obvious. Of course the time taken for disc accessing is no shorter, being rate limited by the disc drive itself, so that formatting and backing-up discs is no faster.

I had hoped that the commands on my ADT ROM, such as BACKUP – which could be post-fixed with T so that they used the Tube – would be faster, but again I could not detect any significant difference (back-up in 2min 13secs for a double sided ADFS disc versus 2mins 16secs without using the Tube) since it makes one less pass between the two discs.

Backing-up from drive 0 to 0 normally requires 25 pairs of disc changes for a double sided ADFS disc and 24 pairs of changes if the Tube is used – a bit disappointing.

However I am delighted with my Turbo 65C102, and at £125 I think it is well worth the money, even if I only use it for the 48,000 bytes in View, faster text manipulation and the excellent printer buffer facility. Anyone involved in heavy number crunching, graphics or long Basic programming will find it essential. The 65C102 co-processor turns the Master 128 into a powerful, fast 192k machine.

● *Next month we'll look at the advanced features of Edit in detail.*

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Please state no of labels across sheets (1 2 or 3)

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	Boxed	Price per box
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EXACT A4	70	2	21.50	18.90
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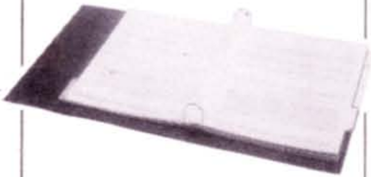

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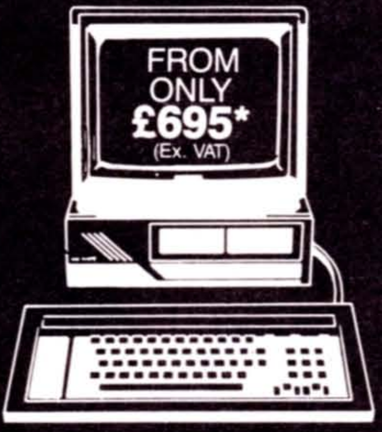

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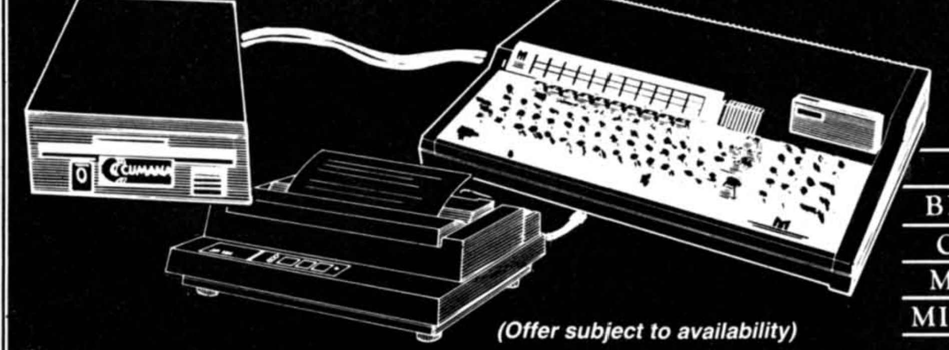

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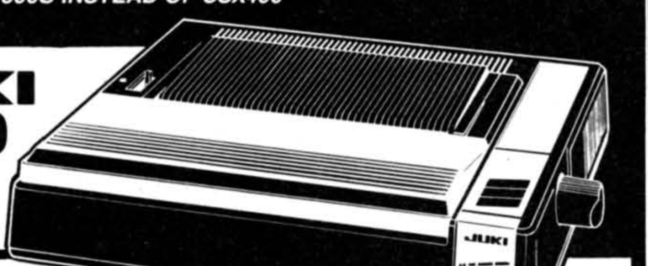
JUKI 5510



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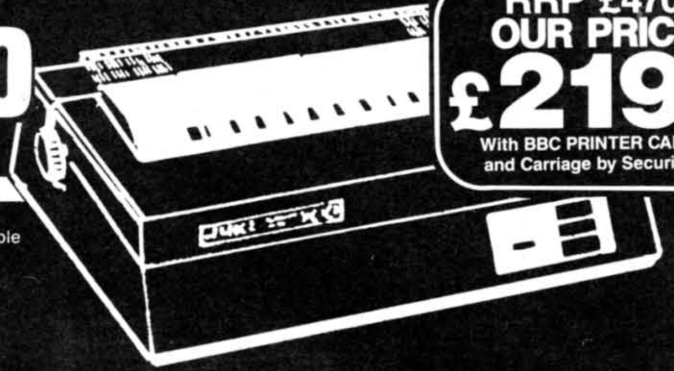
JUKI 6100



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With BBC PRINTER CABLE and Carriage by Securicor

FEATURES

1 18 c.p.s.
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Please contact us for Printer Options.

EPSON LX80

FEATURES

1 100cps — bidirectional logic seeking
2 16 c.p.s. NLQ
3 Italics, bold, underlining and many more font styles
4 Compatible with most software
5 Tractor feed — only £25 extra. Sheetfeed **ONLY £65.95**

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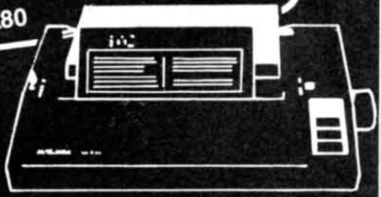

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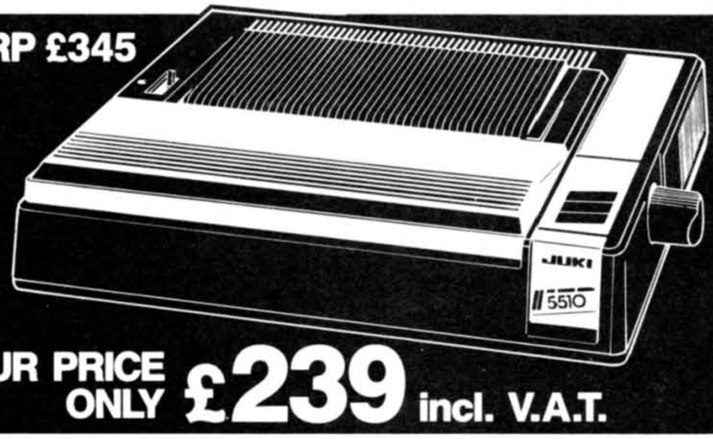

JUKI 5510

FEATURES

1 180cps (draft) bidirectional logic-seeking
2 32 cps correspondence quality NLQ
3 3KB, expandable up to 15KB buffer
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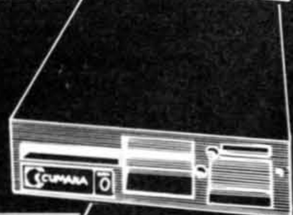

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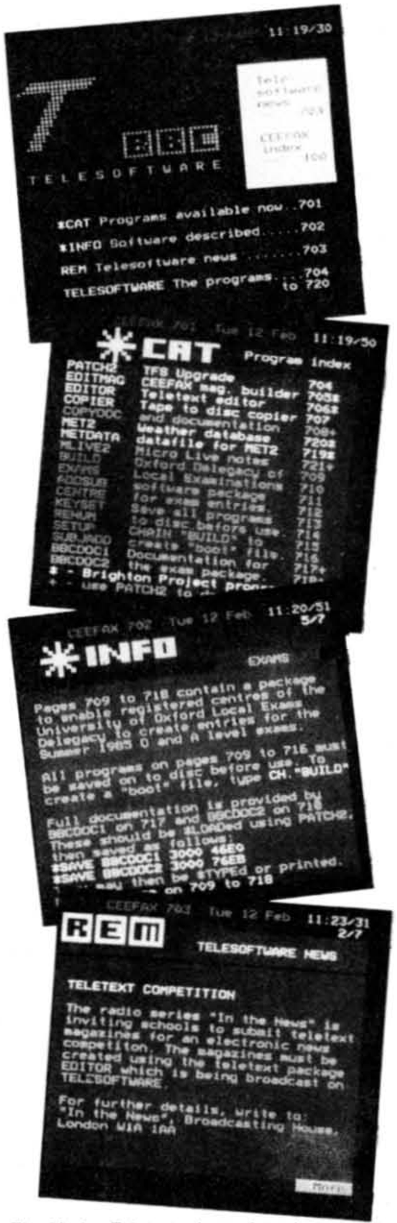
MORLEY ELECTRONICS



```
11:19/30
TELESOFTWARE
Tele-
software
news 703
CEEFAX
index 100

*CAT Programs available now..701
*INFO Software described.....702
REM Telesoftware news .......703
TELESOFTWARE The programs...704
                          to 720
```

```
CEEFAX 701  Tue 12 Feb  11:19/50
*CAT            Program index
PATCH2    TFS Upgrade
EDITMAG   CEEFAX mag. builder 704
EDITOR    Teletext editor     705*
COPIER    Tape to disc copier 706*
COPYDOC   and documentation   707
MET2      Weather database    708+
METDATA   datafile for MET2   720*
MLIVE2    Micro Live notes    719*
BUILD     Oxford Delegacy of  721+
EXAMS     Local Examinations  709
ADDSUB    software package    710
CENTRE    for exam entries.   711
KEYSET    Save all programs   712
RENUM     to disc before use. 713
SETUP     CHAIN "BUILD" to    714
SUBJADD   create "boot" file. 715
BBCDOC1   Documentation for   716
BBCDOC2   the exam package.   717+
* - Brighton Project prog    718+
+ - use PATCH2 to
```

```
CEEFAX 702  Tue 12 Feb  11:20/51
                             5/7
*INFO                EXAMS

Pages 709 to 718 contain a package
to enable registered centres of the
University of Oxford Local Exams
Delegacy to create entries for the
Summer 1985 O and A level exams.

All programs on pages 709 to 716 must
be saved on to disc before use. To
create a "boot" file, type CH."BUILD"

Full documentation is provided by
BBCDOC1 on 717 and BBCDOC2 on 718
These should be *LOADed using PATCH2,
then saved as follows:
*SAVE BBCDOC1 3000 46E0
*SAVE BBCDOC2 3000 76EB
... may then be *TYPEd or printed.
... on 709 to 718
```

```
CEEFAX 703  Tue 12 Feb  11:23/31
                             2/7
REM        TELESOFTWARE NEWS

TELETEXT COMPETITION

The radio series "In the News" is
inviting schools to submit teletext
magazines for an electronic news
competiton. The magazines must be
created using the teletext package
EDITOR which is being broadcast on
TELESOFTWARE.

For further details, write to:
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London W1A 1AA
                               More
```

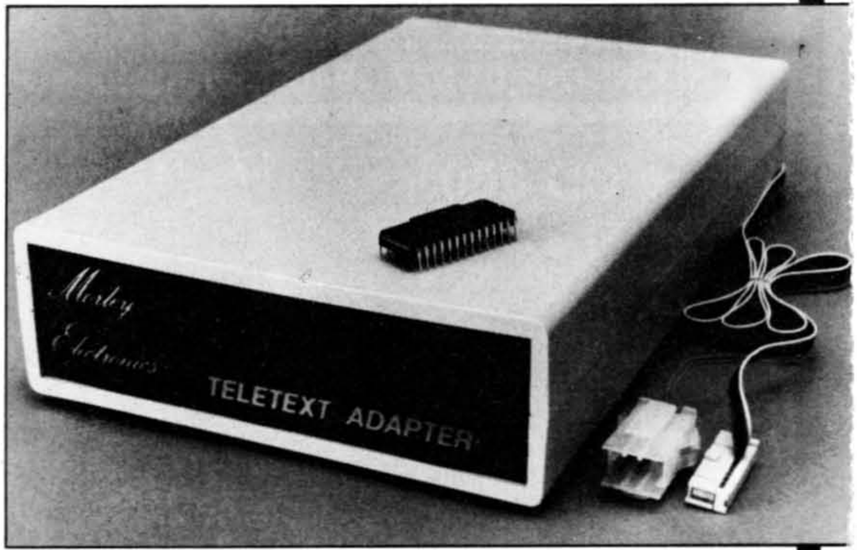

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- Basic 1 & OS1.0 compatible.
- Gives you a real-time clock at your disposal (*TIME).
- Free software upgrades to allow for any enhancements to the teletext service. Eg: extra channels, full field data on cable & satellite systems etc.
- Easy to follow comprehensive user guide.
- No hardware limitations, it can for example receive virtually unlimited numbers of channels.
- Works with Solidisc SWR.
- Utils disc available including printer drivers allows pages to be selected and dumped direct to a printer (no more TV or Radio Times to buy).

ELECTRON TELETEXT ADAPTER

Electron adapter now available, including emulated Mode 7 allowing you to run long Adventure type programs. Please ring for Details.

M/B software DESIGN 7

Easily the best value Mode 7 screen designer on the market today.
Design any mode 7 screen, from simple MENU pages to full CEEFAX standard. This program is an invaluable aid. Designs can be saved to disc as automaticaly numbered files or the program will convert the screen into a BASIC Proc.

INTERFACES DIRECTLY WITH ADAPTER allowing CEEFAX-ORACLE pages to be selected and dropped into editor screen for alteration, saving, or conversion to BASIC. Allows channel change from within program.

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With the Morley adapter you will get a unit that automatically tunes itself in to the required station (no more messing around with screwdrivers in the back of the case), a user friendly menu driven program available on rom or disc, easy to follow instructions and a 12 month warranty. Add to this the free downloadable telesoftware and we are sure that you will agree that we are offering you one of the best bargains on the market today.

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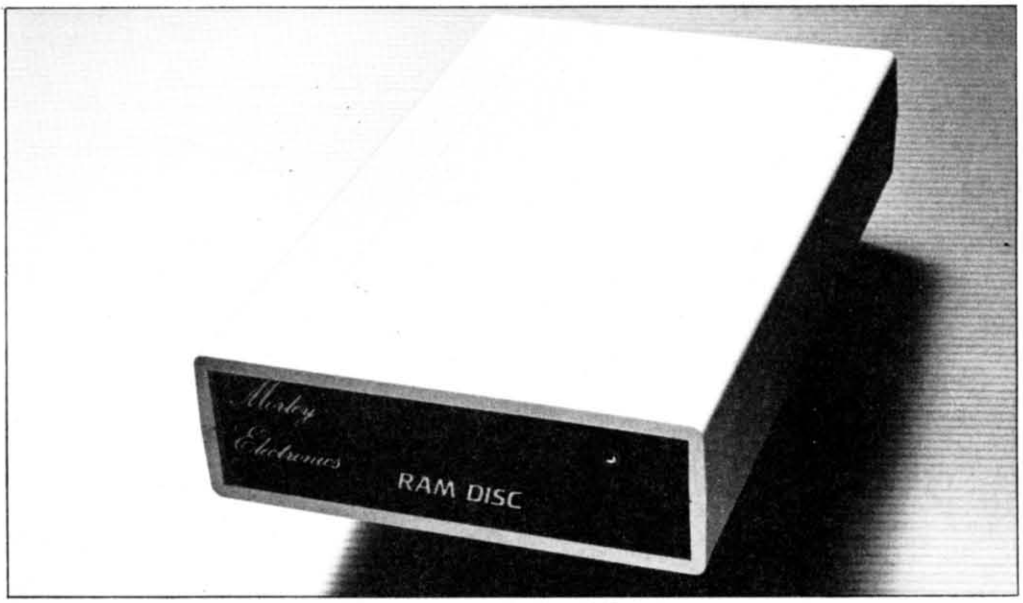
MORLEY ELECTRONICS



Now available the first true MEGA capacity RAMdisc for the BBC or MASTER computers.

This fully compatible unit, currently available in either 1 or 2 megabyte versions comes complete with operating software on ROM, power supply, battery backup and a comprehensive user guide, add to this our usual 12 months no quibble guarantee and we're sure you'll agree Morley have done it again.

FEATURES

1 Megabyte of RAM connected to the 1 MHz bus.

Used with the supplied ROM software programs and files may be saved and loaded from the RAMdisc in the same manner as from a floppy disc with a large increase in speed, for example, a 20K mode 0 screen takes about 3-4 seconds to load from disc and about 0.2-0.3 seconds to load from the RAMdisc.

The RAMdisc ROM operates as a utility ROM working with the current filing system rather than as a separate filing system. Therefore ensures compatibility with any DFS.

The RAMdisc can be selected by a * command to take the place of any drive number from 0 to 9. If the RAMdisc replaces a floppy drive as 0 for example, all commands addressed to drive 0 will be intercepted by the RAMdisc. The default drive no. is 4.

'Dangerous' * commands such as *COMPACT, *COPY, *BACKUP etc are intercepted and the BBC's RAM from page 2 to &7FFF is saved to RAMdisc workspace, and may be recovered using a * command. This prevents accidental corruption of any programs/data in RAM you may have been using at the time. The save operation delays the * command by just under 0.4 seconds. The BBC's RAM can also be saved by an interrupt-driven routine which can be enabled by a * command.

The 'filing system wedge' ROM supplied supports load/save, byte file access, all relevant OSFSC commands, and contains a formatter, verifier and 'sector' editor for use with the RAMdisc.

Catalogue structure allows up to 2,709 files.

APPLICATIONS

Programs and ROMs can be written to take advantage of directly accessing a single RAMdisc, allowing the possibility of spreadsheets with more than 512 × 512 cells, million-character documents with immediate access and editing of any section, manipulation of 2 floating-point arrays each with 228 × 228 elements, a fast-access database with 10,000 100-character records, or even just a large printer buffer!

Accessible through the user's software for direct storage of eg: basic procedures, variables, large arrays etc which can be downloaded into the BBC's RAM or read directly. (We are hoping to be able to supply an extended basic ROM late this year, to allow 'transparent access' to the Ramdisc, which will effectively expand the BBC's RAM to about 1020k.)

OPTIONAL SIDEWAYS RAM UTILITY (suitable for use with any 16k SWR)

Sideways ROM images can be saved to the RAMdisc under a special directory which, when enabled, will be used when an unrecognised * command is trapped for the ROM to load sideways ROMs from disc into sideways RAM. The * command will then be passed to the new ROM image and if still unrecognised the next ROM will be loaded. If no ROM loaded from the RAMdisc intercepts the * command it will be passed to the current filing system as usual. ROMs on RAMdisc can be individually disabled in the same manner as 'real' ROMs in the BBC itself. Up to 104 8k ROMs can be saved onto the standard 1Mb RAMdisc, and the total load time (excluding time taken by the ROMs to process the command) for 100 ROMs is just under 9 seconds. All relevant control software for disabling/enabling ROMs etc. is provided. (Supplied on ROM.)

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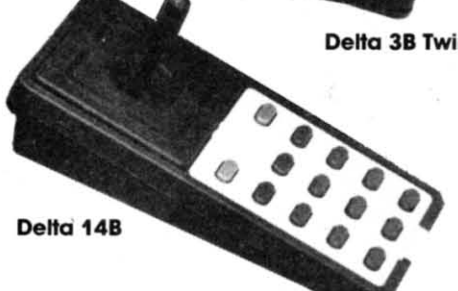
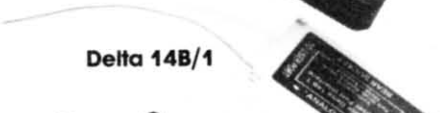
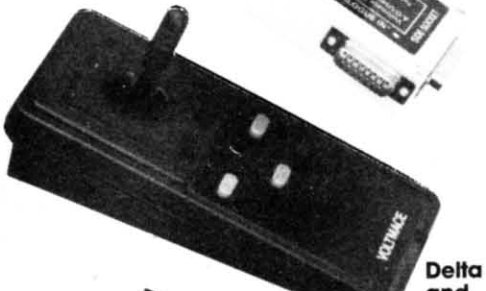


Delta 14B



Delta 14B/1



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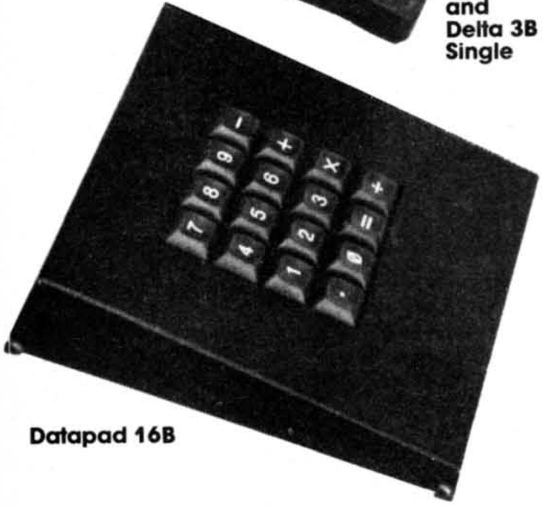

Datapad 16B

DELTA 3B TWIN—BBC B or ELECTRON PLUS 1 £19.95
A direct but improved alternative for the original ACORN joysticks, with 2 joysticks wired to one plug. As with all our joysticks they have the fast action sprung to centre return of the steel shafted nylon covered joystick. The light action makes them ideal to hold and the 3 fire buttons allow left or right-handed use.

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A single joystick that in some ways can act as two. The custom made special "low noise" potentiometers are wired so that it will work as a left hand or right hand joystick. It can even run some programs written for two joysticks and has the fire buttons of both.

DELTA 14B—BBC B £14.95
Our original ACORN/BBC handset. The same super light joystick, but the long life buttons, which have been video game tested for many years, increased to 14 in number. A DELTA 14B/1 is needed to run the keypad but a 14B on its own will work as a joystick and fire buttons, so you can always add the 14B/1 to it later.

DELTA 14B/1 for use with 1 or 2 DELTA 14Bs £14.85
DELTA DRIVER CASSETTE £5.95
The A/D/USER PORT interface box. This gives simultaneous access to both the analogue port, for the joystick part and the user port, for the keypad. Two handsets can be plugged into the box giving a total of 24 user definable keys.
Full instructions are provided to include the keypad in your own programs even in BASIC or for the non-programmer a DELTA DRIVER cassette is available with keyboard to joystick/keypad conversions and keypad set up programs.

DELTA 3S—ELECTRON with switch joystick interface £12.00
For an ELECTRON with a switched joystick interface (Not a PLUS 1) this gives you the same delightful light, fast action of the DELTA joysticks but fitted with a 9 way D plug as per Atari, Commodore, etc. and will run on First Byte interface or similar.

DELTA ASC not illustrated **£9.95**
This little box plugs in series with your analogue joystick to alter its characteristics simply by using a switch. In one set up the joystick will act like a switched joystick, i.e. a slight movement will act as if the joystick has been pushed hard over. In the other mode the joystick only covers the centre half of the A/D converter so that it takes twice as much movement to give the same effect. This makes it much easier to make delicate adjustments to programs like flight simulators.

DATAPAD 16B £39.95
A commercial spec. 16 way keypad. Full travel mechanical keys with double shot moulded keycaps mounted in a low profile metal case. The keys are marked with calculator legend, but the software included allows the pad to be defined as any keys, including function keys or single byte VDU commands such as PRINTER ON/OFF. No tampering with the computer as it fits onto the user port.

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New Rick is a stunner

Program: Project Thesius
Price: £9.95 (cassette) £11.95 (disc)
Supplier: Robico, 3 Fairland Close, Llantrisant, Mid Glamorgan CF7 8QM. Tel: 0443 227354

AFTER playing the first Rick Hanson game, I couldn't really see that Robico could improve the quality of their games. I was wrong – they have.

The dossier that comes in the game's packaging outlines Rick's latest mission.

The enemy has made a breakthrough in particle beam technology and is building an advanced weapons system using it.

Rick's mission is to discover as much about it as he can, which will require him to get the plans for the system. A submarine will drop him at Fisherman's Cove, a secluded spot on the enemy shoreline. The submarine will stay in the area until Rick has finished his mission and will then pick him up.

To help him, various undercover agents in the area have left instructions, some in the form of subtle clues, and others will meet him to aid him in his task.

You start on the beach at Fisherman's Cover. It is very cold and the first thing you should do is find something to help you get dry. When you do find it, removing your wet clothing first will help and if you wipe the towel rather than yourself you should find that you can start to concentrate on your mission.

Examining the towel will provide a clue, and you should now look for a telephone box for further clues. Examining everything when you get there will give you some numbers to try if you go back to the cave and dig.

One of them will provide you with some clothing. A visit back to the telephone box, now that you know which number to use, will allow you to hear a message giving details of the location where you will meet your first contact.

You can ignore the helicopter for the time being, and an examination of your clothing will find you on the outskirts of

Robico
Software
PROJECT THESIUS
© 1985
A MACHINE CODE ADVENTURE
FOR THE BBC B
AND THE ACORN ELECTRON

Winterton, the village where you are to meet your first contact.

While Project Thesius isn't the hardest adventure I've ever played it is the most enjoyable. The location descriptions are full with masses of detail.

A superb game that I can highly recommend.

Paul Gardener

Presentation:	*9*
Atmosphere:	*10*
Frustration factor:	*8*
Value:	*10*
Overall:	*9*

Best of BBC banquet

Program: The Complete BBC
Price: £19.95
Supplier: Audiogenic Software Ltd, PO Box 88, Reading Berks. Tel: 0734 303663

THE Complete BBC is a compilation of seven games in one package, a veritable feast of arcade action.

Game one is The Genesis Project, a space game in which you look from the cockpit of your spaceship and zap colourful aliens which whizz past. The game is quite difficult to master, but is well worth the effort in the end.

Flip requires the player to match pairs of cartoons which are hidden behind a 4 x 10 grid. As each pair is completed the squares reveal parts of a mystery word. The aim is to reveal the word in the least number of attempts.

Chrysalis is a Pac Man-style offering in which you play a caterpillar defending your cabbage patch against the dreaded mutant worms.

Drain Mania is ladders and levels down in the sewers. Collect the lost coins for bonus points and kill the monsters with a well timed head butt. Fast, colourful, and fun.

Space Agent Zelda is a very classy ladders and levels game, the aim of which is to penetrate through the 10 levels of a spaceship and destroy the generator.

The sequel to this program, Bug Eyes 2, is also included in the package. I recently reviewed this as a full price program and was very impressed.

Bug Eyes 2 is also of the ladders and levels genre, but everything is drawn on a massive scale.

The final offering is International Megasports, which occupies one complete side of a cassette. The game consists of the 100 metres sprint, skeet shooting, long horse, archery, hurdles,

high jump and long jump.

You have to qualify in each event before you are allowed to load the next one from tape.

This collection is not a way of selling off second rate games to an unsuspecting public. Several have already been good sellers at their full price, thus making the package even more attractive.

Carol Barrow

Sound:	*7*
Graphics:	*7*
Playability:	*8*
Value:	*9*
Overall:	*8*

DIY adventure author

Program: The Quill
Price: £16.95 (cassette) £22.95 (disc)
Supplier: Gilsoft, 2 Park Crescent, Barry, South Glamorgan CF6 8HD.
Tel: 0446 732765

GILSOFT'S The Quill is a system whereby the non-programmer can still write an adventure game. It first appeared a couple of years ago for the Spectrum, and since then a considerable number of Quilled adventures have been placed on the market for that machine.

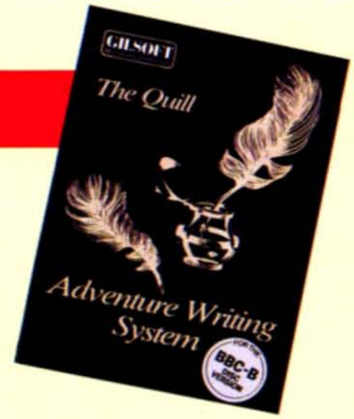
One thing should be made clear – it may remove some of the programming slog from writing an adventure, but there is still some hard work left for whoever uses it.

You still have to design your own game, create locations, descriptions and so on (though they provide an initial action vocabulary), and to be successful commercially you will have to produce a really good game as an end product.

What The Quill does do, however, is to give non-programmers a second way of entering the adventure game market. The first is to create a good story line and persuade an established software house like Level 9 to code and market it. The Quill provides an alternative, do-it-yourself facility.

The manual provides a good, careful introduction to the processes needed to use The Quill properly. There is even a mini-adventure to type in with various checkpoints as you go along to help get the beginner started.

A three level function key strip is provided so that the most crucial status marker-flags in a game can be entered easily – very helpful indeed.



If you have always wanted to write an adventure game, but have been put off by the programming skills required, this product is tailor-made for you. If I had more spare time, I would certainly be wanting to do just that. **Bob Redrup**

Sound:	*N/A*
Graphics:	*N/A*
Ease of use:	*8*
Value:	*9*
Overall:	*9*

Return to space age

Program: Thrust
Price: £7.95 (tape) £11.95 (disc)
Supplier: Superior Software, Regent House, Skinner Lane, Leeds LS7 1AX.

REMEMBER the days when Space Invaders was king, and the buzz which went round the arcades when Galaxians appeared? If you do then you must buy yourself a copy of Thrust from Superior Software. Loading up Thrust was like discovering an old master in the attic.

The rebels intend to launch an attack against the Empire. To this end they have captured several starships – minus engines. Donning your Luke Skywalker gear you must steal new drive units from the Empire's storage planets.

Your spacecraft and all buildings and gun emplacements are displayed as high resolution line drawings. Controls for the ship consist of rotate right or left, thrust, fire, tractor beam and shields.

The game is played as a series of missions of increasing complexity. In the first one the drive unit is on the planet's surface, along with a fuel dump, gun emplacement and nuclear reactor. In subsequent missions the drive will be located in underground caverns.

Fuel can be taken on board by hovering over the dump and activating the tractor beam. Hovering is achieved by pointing the ship away from the planet and using short bursts of thrust to counter the effects of gravity.

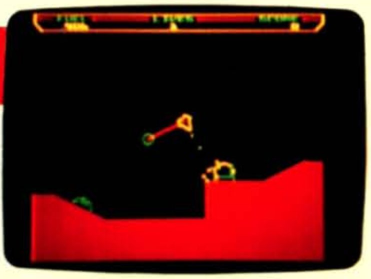
The gun emplacements are deadly accurate but can be taken out by a single shot. Firing at the nuclear reactor will halt the operation of the guns for a short while.

Once you have located the drive unit, the tractor beam can be used to tow it behind your ship, and this is where the fun really begins.

The programmer must be either an ace physicist or an articulated lorry driver, because the drive unit hangs beneath the ship like a pendulum attached to a fixed point on the ship by a solid bar.

Each movement of your craft will cause a realistic movement of the pendulum. As a pilot you must fly as smoothly as possible, counteracting every swing of the drive unit.

Should the swing become uncontrollable you will surely be dragged into a cavern wall.



The mission is completed by towing the drive unit into space and jumping into hyperspace. As with every good arcade game, there is an opportunity for the arcade aces among you to earn big bonus points.

Having emerged from the cavern with drive unit in tow you can fire on the reactor until it goes critical, at which point you have five seconds to make your hyperspace jump. This feat of bravado will earn you an additional 2000 points.

Thrust is a classic game, a game at which the natural games player will excel. This is a definite contender for my game of 1986.

Jon Revis

Sound:	*8*
Graphics:	*9*
Playability:	*10*
Value:	*10*
Overall:	*10*

Thegn turns arbiter

Program: Norman England
Price: £35 plus VAT
Supplier: Fernleaf Educational Software, Fernleaf House, 31 Old Road West, Gravesend, Kent DA11 0LH. Tel: 0474 359037

THE Norman England package consists of a series of four programs, each tracing the development of one character in a Saxon village which is about to be taken over by a Norman knight.

The programs are a good example of computer assisted learning. They do not teach the child directly, but merely demonstrate the effects of his decisions, which can then be analysed via group discussion in an adult's presence.

In program one the pupil plays the role of the Thegn, the leader of the Saxon village. Before beginning the game the Thegn must say how he will run the village.

He must say whether he will listen to the villagers' comments, whether he will protect his own or the villagers' interests, and whether he will fight intruders.

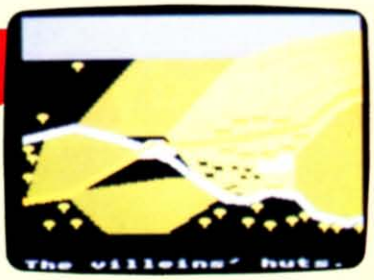
The Thegn must then respond to both domestic problems and the arrival of the Norman knight to whom his land has been given by the victorious William of Normandy.

At the end of the session the program produces an analysis of your decisions and compares them with your original comments on how you were to run the village.

Upon completion of a section you are presented with a code word which can be entered at the start of the next program in the series thereby informing it of your decisions.

Program two follows the role of the Norman knight who takes over the village. The inclusion of this character is valuable as it allows the pupils to see a situation from both sides of the fence.

It is at this point that you appreciate the transfer of data from one section to the next as the knight is faced with the results of the Thegn's decisions from section one.



Two further modules are provided, based upon the life of a villager's wife, and a villager's daughter who wishes to marry a Norman soldier.

The thought-provoking Norman England programs could lead to some interesting classroom discussion. Well worth the investment.

Thomas Brown

Sound: *3*
Graphics: *5*
Educational value: *8*
Value: *8*
Overall: *8*

Learning the fun way

Program: Fun Academy
Price: £14.95
Supplier: Shards Software, 189 Eton Road, Ilford, Essex IG1 2UQ. Tel: 01-514 4871

FUN Academy is a monster-sized compilation of educational programs suitable for children from the ages of 6 to 16. It consists of 22 games supplied on two floppy discs. The documentation is sparse but the on-screen instructions are adequate.

Fun Academy is divided into four sections of related programs, the first being Frac Attack. As its name suggests, this group of programs tackles the tricky subject of fractions.

The graphics used in these and all other programs are constructed using Mode 7 characters. Good use of double height characters makes for a very legible display.

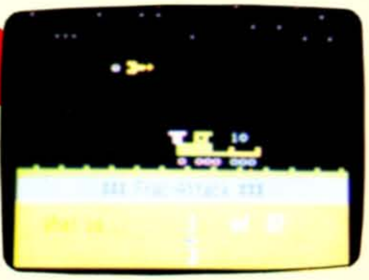
The first program requires you to enter the fraction of a large grid which is shaded in. The program poses a question. The correct answer plus two incorrect answers are being driven along on three trains. Using your spaceship you must bomb the incorrect answers and then rescue the correct one.

This requires quite a high degree of timing as your bomb must hit one small area of the train to destroy it. The other four programs in this section are all of the same high standard.

Fun to Learn is the second group of programs, comprising a mixture of both number and word games. I found only one of these five programs to have any appeal at all, the rest being rather boring.

Section three is titled Monster Maths and is purely number games. Of the five programs three failed to give any graphical reward for success. The programs merely mimicked calculations as they would be performed on paper.

Finally we have Laser Letters, a series of six letter and word games. Three of the programs concern themselves with the placing of letters or words into alphabetical order. Laser Letters requires you to shoot the missing letters into a partially-completed word.

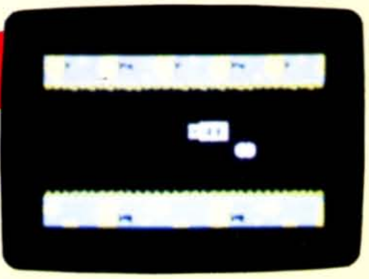


Frac Attack is by far the best section of this collection. The others are playable, but are not going to hold a child's attention for any length of time.

Thomas Brown

Sound: *6*
Graphics: *6*
Educational value: *6*
Value: *6*
Overall: *6*

Speedy spy spectacular



Program: Spy Hunter
Price: £9.95
Supplier: US Gold, Parkway Industrial Centre, Heneage Street, Birmingham B7 4LY. Tel: 021-359 3020

HAVE you ever fancied yourself as a bit of a James Bond behind the wheel of a car but never had the chance to put your driving prowess to the test? If so, Spy Hunter could provide the opportunity you've been looking for.

The game begins with an aerial view of your spy car being dumped on to the road from the back of a weapons van. A quick stab at the accelerator and your car surges forward.

At this stage of the game your car is armed with machine guns, and a fat lot of use they are too. Most vehicles seem impervious to your bullets, so this is a good time to practice your ramming technique.

Fortunately you rendezvous with a supply truck a little further down the road. Having had a missile system fitted you are now in a much better position to eliminate the enemy. Other supply vehicles will provide you with smoke and oil with which to hinder any attack from the rear.

Following a bit of high speed road work you take a fork to the left. Suddenly the road ends and you are tearing towards a river bank. As you crash through the boathouse your car is miraculously transformed into a speedboat and the chase continues.

Having catered for every eventuality, the enemy have also taken to the water, their boats laying mines as they go. Locating a second boathouse, you rejoin the road and begin a second lap of this increasingly tortuous circuit.

In true spy tradition the enemy cars are fitted with a series of vicious spikes, one on each wheel, to shred your tyres.

At last someone has taken the trouble to produce an accurate conversion of a Commodore best seller for the BBC Micro. The graphics are detailed, the theme tune excellent.

Full marks all round.

Jon Revis

Sound:	*9*
Graphics:	*8*
Playability:	*8*
Value:	*8*
Overall:	*8*

Holding off holocaust

VELOCITY
ALTITUDE
TIME TO IMPACT:
07:24:8
AIRCRAFT
SCORE

Program: Raid Over Moscow
Price: £9.95
Supplier: US Gold, Parkway Industrial Centre, Heneage Street, Birmingham B7 4LY. Tel: 021-359 3020

THE Russians have launched a nuclear strike against the US and the only hope of preventing a nuclear holocaust is to send a squadron of stealth bombers into Soviet territory.

These brave pilots must knock out the launch sites and then proceed to Moscow and destroy the Soviet defence centre. The whole mission must be completed before the Russian missiles strike American soil – a total of about seven minutes.

As commander of the US space station you must decide how many of your bombers you will need to scramble to complete the mission.

Each fighter must be flown from the station before it can be used. The fighter is controlled by a series of thrusters which provide propulsion in all directions.

As the action takes place in zero gravity your ship continues to travel in the direction it was last sent unless you take suitable action. The weightlessness is simulated very well, but the plane handles like a flying hippo.

The response to the thrust control is abysmal – having played both the Amstrad and Commodore versions of Raid, I was very disappointed. Fortunately the thrust control is not required in the later stages.

Having guided the fighters to Soviet territory you must now fly the remaining distance at ground level to avoid detection by radar.

Skimming over a smoothly scrolling landscape you must destroy enemy tanks and missiles while avoiding trees and other obstacles.

Having completed this stage you will be confronted by five missile silos. Fire a missile through a small window in each while avoiding enemy fire and the silo will be destroyed.

The whole procedure must be completed three times before you are allowed to launch an assault on the Soviet defence centre in Moscow.

Having left your plane, you single-handedly shoot out the doors of the defence centre, destroy all enemy tanks and take out every Russian guard.

This simple task accomplished, you will find yourself in the reactor room. Eliminate the robot guards, all within the time limit, and the world will be saved.

Despite the clumsiness of the controls when in the space station, Raid Over Moscow can still be relied upon to provide many hours of frustrating entertainment.

Steve Brook

Sound:	*6*
Graphics:	*8*
Playability:	*6*
Value:	*7*
Overall:	*7*

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Low cost, High performance printer. Print speed 100 cps, NLQ mode 22 cps. Full RX80 compatible. Friction feed supplied as standard. Tractor Feed & Auto Single Sheet Feeder, optional extras.

Price: **£189** (carr £6)
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Epson interfaces fit inside the printer to allow connection using techniques other than Centronics.

RS232	**£27**	RS232 + 2K Buffer	**£55**
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CENTRONICS GLP & Brother M1009 (NLQ) Printers

A major price break-through in NLQ Printers from Watford.

At last, a full feature Epson compatible NLQ printer at a price that everyone can afford. Due to Watford's bulk purchasing power and low margins we can now offer this incredible printer deal direct from the manufacturers to our customers.

The Centronics GLP printer which is manufactured by BROTHER (and also marketed by them under their own brand name M1009), features a Near Letter Quality (NLQ) mode using a 23 by 18 dot matrix for each NLQ character (this is the same as is used by the very popular Kaga Taxan printers). The NLQ Font Rom supplied is Watford's own Professional NLQ ROM for the GLP/M1009.

Single, double and quadruple density graphics modes as well as four character widths and super/sub script printing are also supported, along with many other facilities normally found on printers costing twice as much.

Handles upto 9" wide paper. Friction feed standard, tractor feed optional extra.

GLP is bidirectional logic seeking. Has a 9 needle print head. 50 CPS. Parallel interface only.

Special Offer ***£99*** *(carr £5)*
Tractor Feed Attachment **£9**

Centronics GLP Mk2 (Brother M1109) NLQ Printer

100 CPS, (25 in NLQ mode), Bi-directional, logic seeking, Friction feed, tractor feed optional extra, 2K Buffer. Has both Centronics parallel and RS232 both as standard.

Launch Price: **£145** (carr. £5)
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By popular demand our retail shop is now open till 8.00pm every Thursday.

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Similar to the KP810 but has 17" wide carriage for wide print. Gives 156 columns of normal print or 256 columns in condensed mode. Ideal for printing out spreadsheets.

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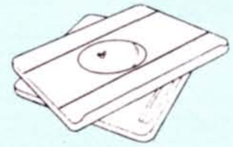

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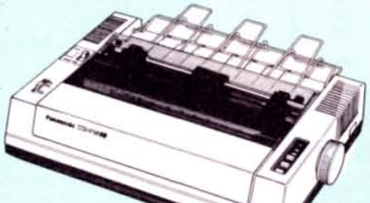
Panasonic KX-P1080



From the prodigious Japanese Stable of Panasonic comes this fabulous new NLQ Dot Matrix Printer

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A full 96 ASCII character set is supported, with an extended set of 32 international characters A 1K Print Buffer alleviates much of the wait time normally associated with printing, whilst the bi-directional logic seeking print head takes the quickest route to print as required.

The draft text is implemented with a 9 × 9 matrix, with Near Letter Quality effected by means of an 18 × 18 matrix.

As an extra special bonus to all Watford customers purchasing the KX-P1080 NLQ Printer, we are currently providing not only 1,000 sheets of fanfold paper completely FREE of charge but also a printer lead to connect the marvellous KX-P1080 to a BBC Micro, absolutely FREE. These gifts alone are worth £15.

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THE EPSON RX/FX/KAGA PRINTER COMMANDS REVEALED

So you bought yourself a new printer, because the salesman in the shop showed you how clever it is and impressed you with all sorts of printouts to show its capabilities – he may even have offered you a special price.

However, now that you have got it home and connected it to your BBC microcomputer, you are wondering how to make it perform these magical tasks. The manual seems to give no clues, and when you type in the example programs, the computer throws the LPRINT statements back in your face.

Now what do you do, when this £400 piece of high technology refuses even to move its head, and you have stayed up until 2 in the morning with copious supplies of coffee, desperately trying to print something out. Once again, Watford Electronics comes to your help with our new book entitled 'THE EPSON FX/KAGA PRINTER COMMANDS REVEALED'.

This book describes in plain, easy to understand English, how to use and make the most of your KP810, Canon PW1080A or any Epson FX80 compatible Printer with the BBC Micro, both from Basic and Wordwise.

It describes in detail how to obtain the maximum in graphics capability from your printer and includes full indexes allowing you to cross index the numerous commands. Every command is explained in detail, with an accompanying BBC Basic program and an example of its use from Wordwise.

Superb Value at **£5.95** (No VAT)

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Continued →

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WATFORD TOPS THE DFS CHART

Watford's Ultimate DFS has scored highest points in ACORN USER's unbiased DFS's Review of July 1985.
In concluding, the reviewer writes "It must be said that Watford's DFS certainly offers a comprehensive range of facilities at a very attractive price". (Please write in for comprehensive details.)

Just compare the features:

Features	Acorn	Watford	
	1.20	Single Density	Double Density
Max nos. of files per disc side	31	62	62
Max disc capacity	800k	800k	1440k
Tube compatible	Yes	Yes	Yes
Built-in Editor	No	Yes	Yes
Built-in Formatter	No	Yes	Yes
Built-in Verifier	No	Yes	Yes
MRUN a file	No	Yes	Yes
MLOAD a file	No	Yes	Yes
Extended RENAME	No	Yes	Yes
Selective COPY	No	Yes	Yes
Default file name	No	Yes	Yes
Disc space distribution	No	Yes	Yes
40/80 Software Switchable	No	Yes	Yes
Wide catalogue	No	Yes	Yes
Close open files	No	Yes	Yes
Improved OPENOUT	No	Yes	Yes
Copy between densities	N/A	N/A	Yes
OSWORD &7F	Yes	Yes	Yes
Full entry point compatibility	Yes	Yes	Yes
Retain information over a break	1.20 partial	1.43 Yes	1.53 Yes
Games compatibility	Yes	Yes	Most
Econet file server	Yes	Yes	Yes
Econet station	Yes	Yes	Yes
Full wildcard facilities	No	Yes	Yes

WATFORD's & ACORN's SINGLE DENSITY DFS

Watford's popular and widely acclaimed DFS has now been available for three years, and has gained a large following amongst serious users of the BBC Micro. Owners of Acorn or any other standard DFS can upgrade to our "Ultimate" DFS merely by replacing their DFS ROM. See below for this upgrade. (P.S. Watford's highly sophisticated DFS is fully compatible with Acorn DFS).

PRICES

- *Complete Disc Interface Kit incl. DFS ROM & fitting instructions* **£54**
- *Acorn's 0.90 DFS Kit complete* **£52**
- *DFS Manual (Comprehensive)* *(no VAT)* **£6.95**
  (P.S. Our comprehensive DFS Manual covers both Acorn & Watford DFSs)
- *Watford's sophisticated DFS ROM only* **£16**
- *We will exchange your existing DFS ROM for Watford's Ultimate DFS ROM for only* **£12**
- *DNFS ROM only* **£17** ● *ADFS ROM only* **£25**
- *Watford's DFS is exclusively available from Watford Electronics. Every ROM carries a special label with our LOGO and serial number.*

WATFORD's DOUBLE DENSITY DFS INTERFACE

The DDFS from Watford Electronics represents a new standard in DFSs for the BBC micro. This is a double density version of our popular single density DFS, and combines all the features of this powerful DFS with the advantages of a system that gives 80% more storage per disc in double density mode. P.S. – Please note that not all DDFSs are capable of providing either the full 80% storage increase, or of allowing a file the full size of the disc – Ours allows both of these! Operates both in Single & Double Density modes.

The typical piece of games software these days is provided upon a protected disc. In order to work on any double density system (including the others on the market) a protected piece of software needs to make calls through the OSWORD &7F routines. To ensure compatibility, the Watford DDFS features probably the most comprehensive and powerful 8271 emulation ever written for a double density system.

PRICES

- *Complete DDFS Kit incl. fitting instructions* **£46**
- *DDFS Manual* *(no VAT)* **£6.95**
- *We will exchange your existing Single Density DFS Kit for our DDFS Unit at* **£35**

Watford Electronics DDFS PLUS for the BBC B Plus

Watford Electronics was the first company to produce a serious alternative Disc Filing System (DFS) for the standard BBC micro. Since then, we have been refining and advancing this sophisticated product right up to today.

Now WE'VE DONE IT AGAIN; Watford proudly presents the Double Density Disc filing system for the BBC B+, with all the advantages of the advanced Watford DDFS available on the new BBC B+ DDFS.

Acting as a powerful alternative DFS to Acorn's '1770 DFS' supplied with the BBC+, this superb addition to any BBC+ greatly enhances it's performance with a simple fitting operation.

DDFS PLUS incorporates all the features of the Watford's popular DFS & DDFS for the BBC B, (at the same time retaining full compatibility with Acorn DFSs), plus it has the following extra features:

Automatic density selection – Full single and double density operations – Extremely powerful and comprehensive OSWORD &7F emulation – Any file can be full size of disc – Density of last access assumed for speed – Automatic 40/80 stepping swapped on error – All Acorn's extra disc commands implemented.

As you can see from the above information, Watford's DDFS for the BBC+ is far more sophisticated and well thought out than the standard. Take any disc produced by any Watford DFS from the standard BBC and catalogue straight off with no problems.

Unlike the Acorn 'ADFS', our DDFS+ system is just as easy to use as the standard DFSs, with no new complex concepts to have to learn. The features within our DFSs have been constantly enhanced over a period of three years during the time that they have been released; significant attention has been paid to feedback from our customers so that the features offered are carefully honed to the requirements of hobbyists and serious programmers alike.

The Watford DDFS+ is supplied with a comprehensive DDFS manual that explains the basics of disc drives, DFSs, etc. Priced at only £30 including the manual, the Watford DDFS+ is surely one of THE best buys you could make for your BBC B+!

Join the leaders in BBC peripherals; join Watford Electronics – committed to supporting the BBC micro.

DDFS PLUS (for BBC Plus) **£30**
(Price includes comprehensive manual)

MYSTERIES OF DISC DRIVES & DFS REVEALED

Are you tired of faulty cassettes, and lengthy loading times? Do you want to upgrade your BBC micro to take discs but you get tied up in the plethora of jargon surrounding the choice and use of these systems.

For instance, what is the difference between single and double density formats, how can you use a 40 track disc on an 80 track disc drive? What is the difference between a DFS and disc interface kit? Should you acquire a single Disc drive or twin? What does 48 TPI and 96 TPI discs mean? These are just a few of the questions you may have asked yourself and never found the answer or maybe you have yet to encounter these questions.

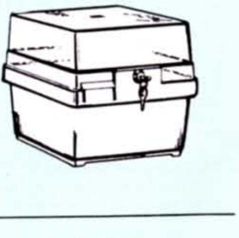
Now the mystery of buying a suitable interface and disc drive for your BBC micro is revealed in Watford's new book entitled 'MYSTERIES of DISC DRIVES & DFS REVEALED'. It describes in fine detail, yet remaining very readable to the beginner, how disc drives operate, the type of interfaces available, which type of discs to use on a disc drive and how data is stored on the discs.

£5.95 (Book No VAT)

DUST COVERS (For our Disc Drives)

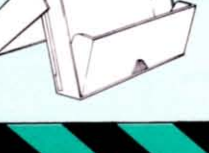
Single CLS (without PSU)	**£3.20**	Twin CLD (without PSU)	**£3.85**
Single CS (with PSU)	**£3.95**	Twin CD (with PSU)	**£3.90**

LOCKABLE DISC STORAGE UNITS



Strong plastic case that afford real protection to your discs. The smoked top locks down. Dividers and adhesive title strips are supplied for efficient filing of discs.

M35 - holds upto 40 discs	**£9**
M85 – holds upto 95 discs	**£11**



PLASTIC LIBRARY CASES

FOR 5¼" DISC STORAGE
holds 10 Discs. **£2.00**

Quality Disc Drives from Watford

To help you decide which drive is the most suitable for your needs (and your pocket!), we have produced the table below.

The first capacity given in the first column indicates the single density capacity. The double density storage capacity is second one, (that within the brackets). All disc Drive type numbers start with the prefix "C".

The tinting on some of the boxes is used to indicate which Drives are 40 track (non-tinted) and which are 80 track (tinted). Both are of Japanese manufacture.

With two prices in a box (e.g. £295/£299), the first price is for the standard drive and the second for the same unit in switchable type. Users of either of the two Watford DFSs will not need switchable drives as their DFS will provide software switching for them.

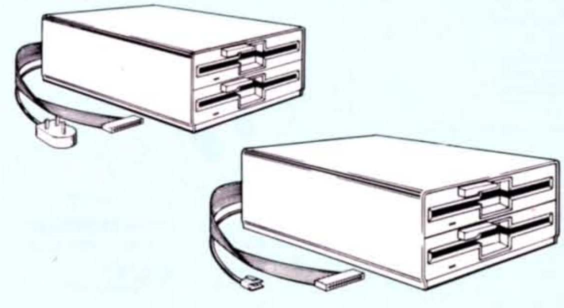
All our Disc Drives (except CLS100) are Double Sided and will operate in both Single and Double Density modes. *Extensive experience of the usage of disc drives suggests that the JAPANESE drives currently represent about the best in terms of speed, reliability and overall "elegance" available for the BBC Micro.*

Various other "manufacturers" of disc drives for the BBC micro (more accurately, "packagers" label other manufacturers drives with their own name). We buy the high quality Epson and Mitsubishi drives in large quantities directly from the manufacturers, package them and sell them at "dealer" prices direct to the public.

If you look around the popular BBC micro press, you will find that the prices we quote for the top quality, new slimline disc drives are, virtually without exception, some of the best around. These prices, coupled with the backup of one of the country's largest distributors of BBC peripherals provides a superb deal.

Unless you anticipate using dual drives in a fully expanded BBC system for long periods of time with little ventilation, then we suggest that our range of "CL" disc drives without the PSU (Power Supply Unit) would be quite adequate: extensive tests within our workshops have confirmed this. All drives are supplied complete with a SPECIAL UTILITIES Disc, Cables and Plugs. The Drives with power supply have a mains moulded plug for safety purposes. (Ideal for Schools & Colleges. All single disc drives with power supply, (i.e. CS100, CS200 & CS400S) are supplied in a twin case with twin data cable for later inclusion of a second drive). At Watford we anticipate your needs of tomorrow not just today!

When using a BBC Micro, most people find themselves short of space. The Watford's BBC Micro plinths form an ideal way of recovering some of this precious space; your BBC, Disc Drive and Monitor can all occupy the same vertical footprint and still be comfortably situated. With the Watford Double plinth, your Disc Drive is mounted vertically at one side, leaving a very valuable area directly in front of you for such useful items as spare discs, pen, paper, reference manuals, etc. Follow the trend with Watford plinth. (Turn to the 12th page of our advert for the Plinths).



Capacity	Drives without P.S.U.		Drives with P.S.U.	
	Single	Twin	Single	Twin
100K (180K)	CLS 100 £95		CS 100 £116	
200K (360K)	CLS 200 £102	CLD200 £185	CS 200 £116	CD200 £199
400K (720K)	CLS 400 £104 £105 CLS400S	CLD 400 £185	CS400 £123 £124 CS 400S	CD400 £205
800K (1.44M)		CLD800 £194 £195 CLD 800S		CD800 £218 £219 CD 800S

- TWIN Disc Drive Case, complete with Power Supplv & Cables **£35**

Securicor carriage on Disc Drives £6

Prefix **C** = *Cased Drive*
L = *Less PSU*
S = *Single*
D = *Double*

Suffix **S** = *40/80 Switchable*

e.g. CLS400S = Cased drive, Less power supply unit, Single 400K, Switchable (40/80 track).

3M – DISKETTES

Top quality 3M – SCOTCH Diskettes from Watford Electronics (Your 3M Appointed Distributors). All our discs carry a lifetime warranty. These discs are quiet in operation and insert positively with their reinforced hub rings. Boxes of 10 supplied complete with self stick disc labels and write protect tabs.

● *10 × 5¼" S/S D/D 40 Track Diskettes*	**£10**
● *10 × 5¼" D/S D/D 40 Track Diskettes*	**£12**
● *10 × 5¼" S/S D/D 80 Track Diskettes*	**£17**
● *10 × 5¼" D/S D/D 80 Track Diskettes*	**£17**
● *10 × 3½" S/S D/D 40/80 track Discs*	**£25**
● *10 × 3½" D/D D/D 40/80 track Discs*	**£35**

TOP QUALITY 5¼" DISKETTES

To complement the range of quality discs and disc drives that WE already sell, WE are now supplying some special offer packs of 10 high quality discs. Each Disc has a reinforced hub ring and carries a lifetime guarantee. These are supplied complete with selfstick labels and packaged in an attractive plastic library disc box to protect them from damage. We strongly recommend these Discs.

DON'T SETTLE FOR LESS, BUY THE BEST

- *10 ×* **M4** *S-S D/D 40 Track Discs* **£9**
- *10 ×* **M5** *D/S D/D 40 Track Discs* **£11**
- *10 ×* **M7** *D/S D/D 80 Track Discs* **£15**

- **3"** *Double Sided Discs* **£4** *each*

Special BULK OFFER on 5¼" DISCS

(Supplied packed in plastic storage Units)
(Lifetime warranty on Discs)

Type	Description	Pack of 20	Pack of 50
M4	Single/Side Double/Density 48TPI	£17	£42
M5	Double/Side Double/Density 48TPI	£21	£56
M7	Double/Side Double/Density 96TPI	£29	£70

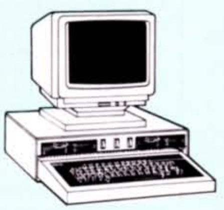
DISC ALBUMS

Attractively finished in antique brown leather look vinyl. Stores upto 20 Discs. Each disc can be seen through the clear view pocket.

£4

ACORN WINCHESTER DRIVES

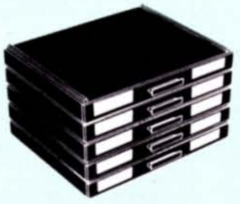
Supplied complete with Level 3 File Server Software.
10 Megabytes **£1050**; 30 Megabytes **£1549**



CDP 800S

Twin 800K Double sided 40/80 track switchable disc drives mounted in an attractively finished Beige colour plinth for the BBC Micro. Supplied complete with integral power supply, cables and Utilities disc. The switches are mounted on the front panel for ease of use.

Introductory price: **£239**
(Securicor Carr. £7)



STAK-PAK

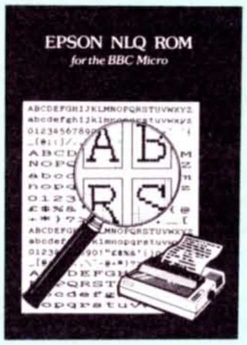
The unique computer program filing and storage system. Made of tough black plastic, these compact drawer sections hold two cassettes each and lock together vertically to form miniature cabinets of any height. Each drawer section has two C12 Data Cassettes with labels plus external index card.

Five twin Packs incl.
10 Cassettes Only: **£6**

FLOPPY HEAD CLEANER KIT

The heads in floppy drives are precision made and very sensitive to dirt. The use of a cleaner Kit is a sensible precaution against losing valuable data. It is recommended to clean the drive head once a week. It is very simple to use.

£8



Harness the full potentials of your Epson RX & FX Printers. Impress your friends and business colleagues with the quality of your letters and printed material with Watford's very simple to use EPSON NLQ! (Near Letter Quality) ROM. Suitable for FX80, RX80, RX80F/T, FX100.

Look at the features:
- Simply type *NLQ80/100 and a single VDU code to use NLQ print.
- NLQ is then available without any modifications from BASIC, WORDWISE, VIEW (with NLQ DRIVER) or virtually any other program or language.
- Single codes select PROPORTIONAL type (yes even on the RX80); ENLARGED type; UNDERLINED type. These features can be used seperately or in any combination.
- Full UK character set; Standard 'pica size'; Proportional spacing; Enlarged; Underlined; Normal type.

The NLQ ROM is supplied complete with comprehensive manual.

P.S. NLQ ROM is compatible with the Torch Z80 system and can be used from within the Perfect Writer software.

Only: £25

VIEW PRINTER DRIVER for NLQ ROM

This specially written printer driver has been designed to allow View access to the full features of our NLQ ROM.
A must for all VIEW and NLQ ROM users.

£7.00
(Hi-View compatible)

THE NLQ DESIGNER

KAGA KP810/910 and Canon PW1080 are two superb printers, as our many thousands of satisfied customers would surely attest to. One of it's particularly strong points is the NLQ option that it offers; perhaps one of the more weaker points is the effort required to design your own custom NLQ font.

Well the solution is here NOW in the shape of Watford's NLQ DESIGNER ROM! For the BBC Micro. This powerful piece of software allows easy design and entry of a full NLQ font, with further fonts recallable from disc. Once a font has been programmed with the versatile NLQ DESIGNER, it can be saved to disc, downloaded to your Kaga (or Canon) printer, or even programmed into an EPROM (given the appropriate hardware) and then plugged directly into your printer so that it is available immediately when you turn it on. Downloadable Fonts require 6264 RAM chip fitted. Now BBC Master compatible.

A 40 or 80 track (please specify) disc containing 3 example fonts is included in the package.

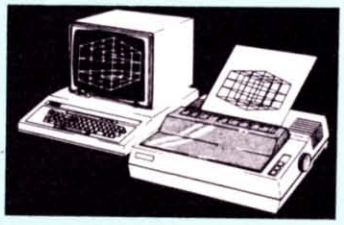
(P.S. This ROM is not suitable for Epson printers.)

- NLQ Designer ROM & FONT Disc **£25**
- Kaga Individual FONT ROMs **£15**

(Write in for further details).

ALL PRICES EXCLUSIVE OF VAT

DUMPOUT 3



A highly sophisticated screen dump ROM. This has to be the most flexible and powerful screen dump ROM yet produced for the BBC micro. It will put on paper anything you see on the screen, including all Mode 7 facilities etc. We have to admit that there is one facility that we cannot replicate – if anyone can supply flashing ink we would like to know!
The ROM also provides window setting utilities and two new OSWORD calls that allow mode 7 graphics pixels to be read and plotted using the standard graphic co-ordinate system. The latest version includes a graphic dump trigger for dumping screens from games whilst they are running.
Two commands are used to operate the dump routines:
*GIMAGE – This provides a full graphics dump of any graphics mode, plus modes 7 and '8'. There are many optional parameters but you need only specify the parameters you wish to change.

Features available include:

- Vertical and horizontal scaling through all the graphic modes and mode 7
- Rotation of the image produced through 90, 180 and 270 degrees
- Left hand indentation setting
- Screen dump window definition
- Colour grey scaling
- Two tone fast dump
- Special colour mask
- Mode 7 contrast expansion
- Mode 7 contiguous dump
- Key triggered dumps
- User port switched dumps

What does the independent press say!

Practical Electronics, May 1985
"The Dump Out 3 ROM from Watford Electronics represents one of the most sophisticated types of printer dump utilities available for the BBC Micro . . .".

"an extremely sophisticated and powerful dump utility".

"VERDICT – Dump Out 3 ROM has all the facilities which you are ever likely to need for producing printer dumps. The facilities available work extremely well and if printer dumps are something which you require, then this ROM can be recommended to help you to get the best out of your dot matrix printer".

The Micro User Feb. 1985.
"Well, here is that winner"!

"provide(s) some rather sophisticated screen dumps. Producing high resolution paper copies of graphic screens in any (graphics) mode will be the major reason for buying this ROM, and this is where Dump Out 3 performs PAR EXCELLENCE". (Our capitals for their italics.)

"The versatility of *GIMAGE (the graphics dump command) when using these parameters is amazing. Pictures of almost any size, shape, contrast or distortion may be produced without the need for a reducing photocopier or trick photography".

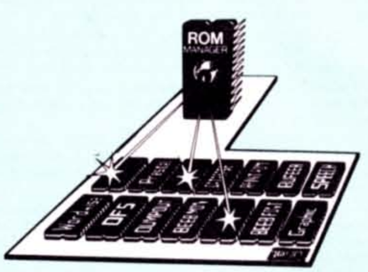
"Without reservation I wholeheartedly recommend the Dump Out 3 ROM as the ultimate screen dump facility for the BBC micro. It is easy to use yet highly versatile, and caters for all BBC screen modes in multitone high resolution printing. Whole, partial, rotated and scaled screens may be dumped to almost any BBC compatible dot matrix printer (see our list at the end of this advert). At £25 it must represent excellent value for money and surely cannot be beaten".

Designed for use with the following printers:

GLP, GP80/100/250, CANNON, STAR, KAGA/TAXAN, NEC, SHINWA CP80, GEMINI, EPSON MX/RX/FX, M1009, NEC PC8023, DMP100/200/400, Mannesman Tally etc.
Price including comprehensive manual

£25

ROM MANAGER



Probably the most powerful way of expanding the BBC micro is from the use of Sideways ROMs. One problem faced by the avid ROM collector is that of ROM command clashes. The solution is very simple in the form of the ROM that "Provides comprehensive management of all your installed ROMs". (Quote from BEEBUG November '84.)

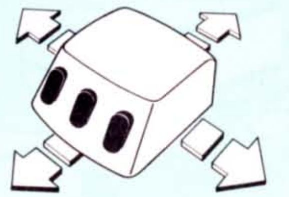
Basically, ROM Manager offers you the ability to turn off any installed ROM, or to send any * command to any specific installed ROM. It is said that imitation is the sincerest form of flattery – Acorn's BBC Plus features many of the abilities of this powerful ROM.

Many more facilities available.

SPECIAL OFFER £18

THE AMX MOUSE

The AMX Mouse needs no introduction. It is simply the best.



Now supplied with the NEW SUPERART Software ROM & Disc at no extra cost.

ONLY: £65 (carr £1.50)

FREE With every AMX Mouse package purchased from us, we are giving away, absolutely FREE, our popular Colour Art software package worth £15.

AMX DESK Package	**£19.00**
AMX UTILITY Package	**£11.00**
AMX SUPERART Package	**£42**
AMX PAGE-MAKER Pack	**£42**
AMX 3D ZICON Disc	**£20**
AMX Database Disc	**£20**
AMX XAM Educational	**£20**

RB12 MARCONI TRACKER BALL

This popular unit is supplied complete with software.

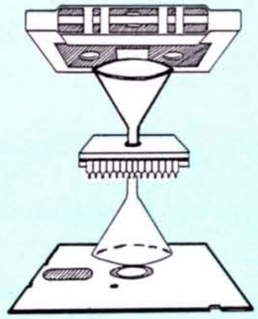
Price: **£50**

FLEET STREET EDITOR

Software pack **£35**

TRANSFEROM

(Tape to Disc Utility)



Not compatible with 1770 DFS.

This advanced and sophisticated utility ROM for the BBC Micro has the following features:

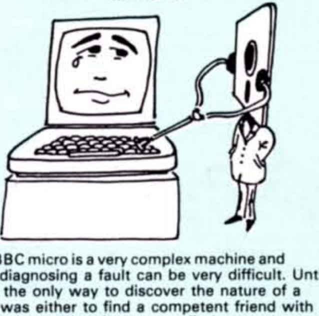
- Fully menu driven for ease of use
- Copes with locked programs
- A very comprehensive built in copying features
- Copies very long adventure games
- Supplied with comprehensive manual

TRANSFEROM is now available in BOTH single and double density versions. The single density version works with both the Acorn and Watford single density DFSs. The double density version works with the Watford DDFS system only.

TRANSFEROM takes your software on tape and saves them onto disc. TRANSFEROM does not stop when one disc is full; you just insert another disc in and carry on with that one! Surely this is the most valuable investment you could make if you have tape software that you wish to transfer to disc! Please specify version required – Single or Double Density.

£25.00

DIAGNOSTICS DISC



The BBC micro is a very complex machine and thus diagnosing a fault can be very difficult. Until now, the only way to discover the nature of a fault was either to find a competent friend with a large degree of patience or to find your nearest dealer and pay him to find out what is wrong.

At Watford Electronics, we realise how difficult it can be when faced with a problem, finding yourself a long way from your nearest dealer, or even just uncertain about your Beeb's health, but not wanting to waste time and money taking it to be looked at.

The solution to these problems is here now, in the form of the Watford's Diagnostics Disc. This excellent utility is specially designed to test out the following areas of your Beeb:

RAMs, ROMs, ULAs, Sound, Keyboard, Disc, RS423, ADC, User Port, Printer Port, Cassette, Joysticks, Speech, Disc Drives, 6502 and Z80 2nd Processors.

This utility is an invaluable aid for all those who take the reliability of their system seriously. A comprehensive manual provides full operating details and a list of possible causes and remedies for any faults that you may find along the way. The package also enables a permanent equipment and service record to be maintained.

Only £20.00

ROMAS

THE CROSS ASSEMBLER AND MACRO EDITOR FOR SERIOUS PROGRAMMERS!

ROMAS is a carefully designed, sophisticated yet simple to use, development system for serious assembly language programmers. Using the BBC as the development system, you can choose your target system from the following processors:

6502, 65C02, Z80, 8085, 8041, 6809 and Z8 P.S. This includes the Acorn 6502 & Z80.

ROMAS features a powerful expression analyser, making complex table easy to generate. To aid in documentation, fully formatted assembly listings may be produced, with full symbol table output at the end.

ROMAS is provided with a powerful cross referancer to produce a listing of all the labels in a given "source" program; this makes it easy to check to see if you are about to duplicate a label.

The Macro Editor

Features of this powerful editor provided with the ROMAS package include:

- Works in all 40 and 80 column screen modes
- Fast load and save speeds
- Continuous line and column number displays
- Search, replace and move; all available in macros
- Command repetition

The ROMAS package includes a comprehensive manual, providing detailed documentation and plenty of examples.

A give away at . . . **Only £45**

Please specify 40 or 80 track disc when ordering.

ROM-SPELL

"way ahead of any competition"

ENGLISH DICTIONARY
ROM SPELL

ROM-SPELL is probably THE most advanced and fastest spelling checker available for the BBC Micro. Printed below are some extracts from a recent independent review (A&B Computing Nov. '85), which we feel sure will convince you that this is THE only spelling checker worth considering.

"The editing system is very neat and simple, instead of replying to queries and beeps all of the time . . ."

"The other feature which places ROM-SPELL way in front of any competition is the ability to examine the user dictionary, so any spelling mistakes that have found themselves on the disc can be examined and taken out if necessary".

". . . that it is compatible with many of the popular word processors on the market is a good indication that ROM-SPELL is going to be a very popular product indeed".

". . . ROM-SPELL is by far the best spelling checker for the unexpanded BBC B (with or without word processor). It boasts features which are hard to find on conventional spellcheckers on CP/M and MSDOS, namely Spellstar and has a speed/performance ratio of roughly the same as its CP/M cousin. The difference is that the CP/M version would cost the best part of £500".

". . . and with such vital house keeping features as an ambiguous word checker, the ability to edit the user dictionary, a comprehensive manual that is both easy to read and actually ENJOYABLE to learn from, . . . I feel confident that ROM-SPELL will woo the word processing public with no problems at all".

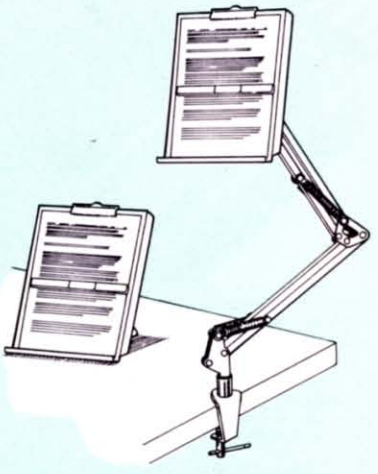
Compatible with: View, Wordwise & Wordwise

Don't settle for less, Buy the best.

£25

(Not compatible with 1770 DFS)
(Please state 40 or 80 track disc)

COPY HOLDERS



How often have you been about to type hand written notes into your computer when you find that there's nowhere to rest the paper or that your notes are resting at the wrong angle to read the type? Whether the notes be your latest program or the draft of a new trilogy, the new Manuscript Holders from Watford are superb for holding your paper at the ideal height and angle to allow you read and type in ease and comfort.

Available in desk resting and shelf clamping versions, these two units hold your paper firmly by means of a magnetic ruler and a clip grip.

Mounting to a convenient flat surface, the two joint anglepoise Manuscript Holder allows the paper to be positioned at virtually any convenient angle whilst only taking up a fraction of the surface area that the paper being held does.

The smaller desk resting Manuscript Holder is useful for the more organised desk where the problem is simply holding the paper at the right angle.

Whatever desk arrangement you use, surely you deserve a Watford Manuscript Holder!

Amazing value at only
Desk Top **£10** (carr. £2)
Angle poise **£14** *(carr. £3)*

All prices in this advert are exclusive of VAT.

REPLICA 3

This new improved REPLICA 3 from Clares is a very powerful disc based TAPE to DISC Utility. It now transfers even more programs than ever before. Replica 3 will not work with all programs but then neither will anything else. 30,000 Replicas have been sold to date. It has to be good.

£13 (40 or 80 track)

BEEBMON

The most powerful machine code monitor for the BBC Micro **£24.**

DISASSEMBLER ROM

ONLY **£16**

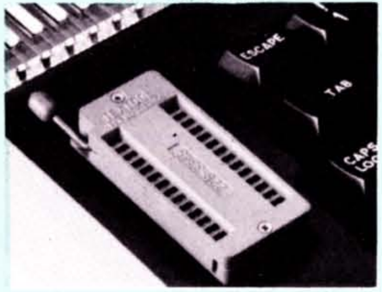
THE INVESTIGATOR

This sophisticated Utility program on disc, enables you to make security back-up copies of most of your valuable Disc Software. Makes full use of all 8271 (will not run with double density DFSs) facilities to discover the precise format of your protected disc so that an exact copy can be produced. Supplied with detailed instructions. Please specify 40 or 80 track disc when ordering.

Only **£20**

Continued →

SIDEWAYS ZIF SOCKET



Allows you to change your ROMs quickly and efficiently, without opening the lid. The ZERO INSERTION FORCE (ZIF) socket is located into the ROM Cartridge's position.

- Very simple to install. NO SOLDERING required. The ZIF (Zero Insertion Force) eliminates the possibility of damage to your ROM pins when inserting & extracting.
- The low profile of the socket allows unrestricted access to the Keyboard.
- All data and address lines are correctly terminated to ensure correct operation of suitable ROMs with the BBC micro. We also supply a purpose designed see-through storage container with anti-static lining, allowing you to store up to 12 ROMs, protecting them from mechanical and static damage.
- This versatile hardware solves the problem of running out of socket space. Simply lift the ROM from the ZIF & insert a different one (No pulling or pushing of Cartridges. It is a must for all professionals and Hobbyists alike.)
- BBC, B+ and Master compatible.

ONLY **£15** (carr £2)

Low Profile CARTRIDGE SYSTEM

Complete System consists of: Low profile ROM Cartridge, Socket housing, Cable assembly, 5 labels and a library storage rack.

Complete System	**£12**
Spare Cartridges	**£2.50**
Spare Rack	**£1.50**

16K Sideways RAM Modules

This is it! The revolutionary design RAM Module you've been waiting for. Complete with such features as read and write protection, these new modules from Watford Electronics are ideal for the hobbyist, software developer and ROM collector.
Key points to note about this new addition to the Watford range of products are:

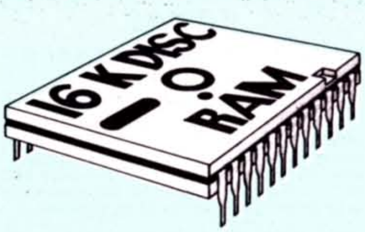
- Write protection (useful in a variety of circumstances).
- Read protection (allows recovery from ROM crashes).
- Compact construction.
- May be fitted in systems even with a ROM board.
- Multiple units may be fitted, even with a ROM board.
- No overheating or overloading problems.
- Free utilities disc supplied.
- Can be used as a 16K PRINTER BUFFER.
- Ideal for professional software development.
- Supplied with utilities software disc.

Only: **£29** (carr £2)

Optional extras

READ and WRITE protect Switches	**£2** each
Battery for Battery Backup	**£3**

All prices exclusive of VAT



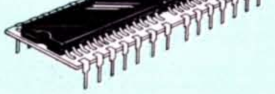
This is the RAM you've been waiting for!! This battery backed up, write protectable 16K sideways RAM board allows you to run from disk every sideways ROM available. Beware of other sideways RAM boards which are not backed up as certain ROMs will not run in these boards even though the RAM can be write protected. The Battery Backup facility allows retention of DATA after power off. On switch on the Micro will think the WATFORD DISC RAM is a ROM. Features available are:

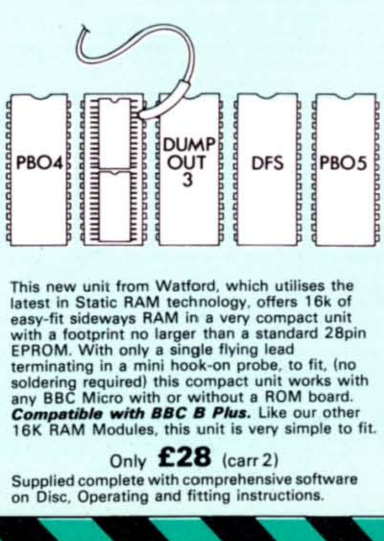
- No soldering or modifications to BBC micro necessary.
- Plugs into normal ROM socket fitting neatly under the keyboard allowing room for other add-ons.
- Easy to use. Comes with disk based software to SAVE and LOAD ROMs. Allows you to make backup copies of your ROMs.
- Disk software can be copied onto other discs when disc is full.
- No messy plugging and unplugging of your ROMs. Simply Load the one you want into DISC RAM.
- Ideal for Professional users to develop ROMs. Backup facility allows testing of final versions without using EPROMs.
- The switch provided allows backup and write protection to be switched off externally.
- Can also be used as 16K printer buffer RAM in conjunction with our Buffer & Backup ROM.

New Low Price: £30 (carr £2)

P.S. 16K DISC RAM Board is not designed to work in conjunction with a Sideways ROM Board.

SOLID STATE 16K SIDEWAYS RAM





This new unit from Watford, which utilises the latest in Static RAM technology, offers 16k of easy-fit sideways RAM in a very compact unit with a footprint no larger than a standard 28pin EPROM. With only a single flying lead terminating in a mini hook-on probe, to fit, (no soldering required) this compact unit works with any BBC Micro with or without a ROM board. ***Compatible with BBC B Plus.*** Like our other 16K RAM Modules, this unit is very simple to fit.

Only **£28** (carr 2)

Supplied complete with comprehensive software on Disc, Operating and fitting instructions.

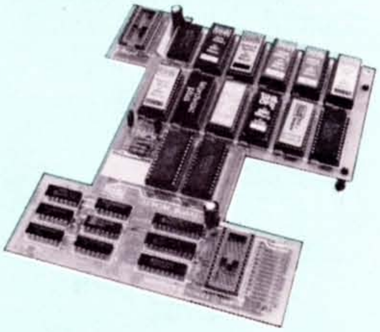
Do you find the 16K Sideways RAM Units confusing? If so, we have compiled this quick questionnaire to help YOU decide which is the best one for you. If the answer to any of the questions is yes, then use the index number to select from the boards below. Options in brackets indicate possible secondary choices.

Do you require:

- Sideways RAM for a BBC B? Choose 1, 2 or 3.
- Sideways RAM for the B+? Choose 1.
- A small, basic module? Choose 1.
- A sideways RAM module for a ROM board? Choose 1, 2 or 3.
- An easy to use utilities disc? Choose 1, 2 or 3.
- More than one module installed at once? Choose 1 or 3.
- To use sideways RAM as a printer buffer? Choose 1 or 3.
- Battery Backup? Choose 2 (3).
- Write protect for RAM (makes ROM look like RAM)? Choose 2 (3).
- Read protect (allows recovery from crashes)? Choose (3).

Key:
1) Solid State 16k Sideways RAM
2) 16k Disc RAM
3) 16k RAM module

SOLDERLESS SIDEWAYS ROM SOCKET BOARD



In the May 1986 Micro User's independent review, the writer concludes, "The board has been well laid out. Its position is much better than others – not over the HOT RAM chips and further away from the disc controller area". "I give the solderless ROM board the thumbs up and wish it success".

This brand new board from Watford Electronics is designed specifically for those wishing to add a ROM board to their own BBC without the need to perform any soldering.

This new board expands the total possible number of ROMs in a BBC from 4 to 16. Also permissable, are various configurations of RAM (up to 16k) and different sized EPROMs (see below).

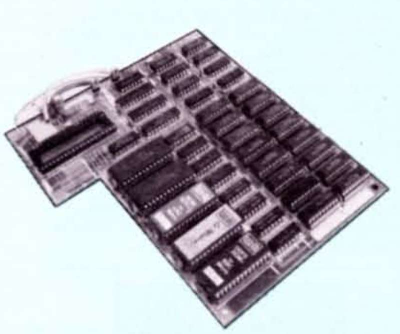
Unlike our competitors inferior boards, the ONLY upgrade required for fitting battery backup to the Watford Solderless ROM board (all Watford ROM boards, actually) is the fitting of the battery itself. (No other expensive components are required.)

- The key features of this new, no fuss, easy to install quality product from BBC leaders Watford Electronics are as follows:
- Increase your BBCs capacity for ROMs from 4 to 16.
- **No soldering required.**
- Very low power consumption.
- Minimal space required.
- Compatible with Torch, DDFS, RAM Card, 2nd Processor, etc.
- Socket 14 can take the following chips: 2716, 2732, 2764, 27128, 6116, 6264.
- Read protect to make RAM "Vanish"; allows recovery from ROM crashes.
- Battery backup option for RAM chips.
- Supplied ready to fit with comprehensive instructions.

Price: Only £32
Battery backup fitted **£36**
(carriage £2)

Watford ROM/RAM CARD

A must for all serious users



Watford Electronics announced the first ever commercial ROM board for the BBC micro, the Watford Electronics 13 ROM Socket Board 3 years ago. Following the success of this board, we have designed what probably represents the ultimate in expansion boards, the new Watford Electronics ROM/RAM board. This highly versatile and sophisticated board represents the latest in "2nd generation" sideways ROM technology for the BBC micro, designed to satisfy the serious BBC user.

- NO SOLDERING required to fit the board.
- NO overheating problems.
- No User Port corruption (avoids problems with the mouse, modems, Eprom Programmers, etc.)
- Fully buffered for peace of mind.
- Firm mounting in BBC micro.
- Compatible with all BBC micros (not BBC+ or Master).
- Total number of ROMs increased from 4 to 8.
- Up to 8 banks of sideways RAM (dynamic).
- Option for 16k of Battery backed CMOS RAM (CMOS RAM needs one ROM socket).
- Software Write protect for ALL RAM.
- Read protect for CMOS RAM (ALLEVIATES crashes during ROM development).
- Separate RAM write register (&FF30 to &FF3F).
- Automatic write to currently selected RAM socket for convenience.
- Accepts any ROM.
- FREE utilities disc packed with software.
- Compatible with our DDFS board, 32k RAM Card, Delta Card, sideways ZIF, etc.
- Large printer buffer.
- UNIQUE Fully implemented RAM FILING SYSTEM (similar to the popular Watford DFS).
- ROM to RAM load and save facilities.

The SFS (Silicon Filing System) can utilise up to the full 128k of RAM (with the SFS in any paged RAM) as a SILICON DISC. This behaves as a disc drive, with all the normal Watford DFS features (including OSWORD &7F for ROM-SPELL, etc.) to provide an environment that looks like a disc but loads and saves MUCH faster.

The ROM/RAM Board plugs into the 6502 CPU socket. This leaves free all the existing ROM sockets, which can still be used normally.

Any ROM that can be plugged into the BBC micro's own ROM sockets may be used in the ROM/RAM Board.

The ROM/RAM Board is supplied with all ordered options fitted as standard. Upgrade kits (with full instructions) are available for all of the options, should the user wish to upgrade in the future. Please write in for further details.

INTRODUCTORY PRICES:

● *ROM/RAM card with 32k dynamic RAM*	***£45***
● *ROM/RAM card with 64k dynamic RAM*	***£69***
● *ROM/RAM card with a massive 128k dynamic RAM*	***£109***

(carriage on ROM/RAM Card £3)

OPTIONAL EXTRAS:

● *16k plug-in Static RAM kit*	***£3***
● *Battery backup*	***£3***
● *Read and Write protect switches*	***£2** each*
Complete ROM/RAM board (all options installed)	***£125***

Le Modem

The MODEM from Watford

At last a professional MODEM for the BBC Micro. Unlike other 'Modem packages' this is a complete package there are no extra software costs to get 'up and running'. Of course Le MODEM is multi-standard, i.e. 300/300, 1200/75 & 75/1200 UK and BELL (USA) are all supported.

The features that make Le MODEM such good value are:

- *A complete communications terminal that transforms your BBC Micro into a very powerful World/wide data transfer system.*
- ***Auto Dials, Auto Answers, and is completely controlled by your Micro. There are no external controls!***
- *Allows you to access PRESTEL, B.T. GOLD, THE SOURCE, MICROLINK, MICRONET, MICROWEB, THE TIMES NETWORK, MICRO LIVE (BBC TV database), CITY BB and more.*
- *Designed to be SIMPLE but SOPHISTICATED. To LOGON to a data base all you have to know is its TELEPHONE NUMBER, Le MODEM does the rest.*
- *Supplied with a comprehensive telecomms package in a 16K sideways ROM which includes a FULL PRESTEL terminal allowing TELESOFTWARE to be downloaded.*
- *A comprehensive 80 column terminal. This includes XMODEM error checked transfer protocol, to allow error free data transfer anywhere in the world!*
- *FULLY controlled by simple *COMMANDS allowing you to control it from your own BASIC programs. To get you started we supply a FREE disc of bundled software!*
- *Connects to the 1MHz bus. A *AUDIO ON/OFF command allows you to actually hear the telephone line through your BBC micro loudspeaker.*
- *Completely self contained with internal mains power supply. (Even a free mains plug is fitted!) A *TEST facility gives ON SCREEN indication that Le MODEM is working correctly.*
- *Packaged in such as way that you need nothing else except a BBC Micro to communicate with computers all over the world.*
- *FREE 3 months subscription to MicroLink.*

- *BT Approval applied for.*

Price: **£89**
(carr £3)

PROHIBITED from direct or indirect connection to any telecommunication system run by British Telecommunications. Action may be taken against anyone so connecting this apparatus

(Price includes, Le Modem, Software ROM, Cables & Comprehensive Manual)
(Write in for further details)

Nightingale Modem

SPECIAL PRICE to our Customers

£115

(carr £3)

(Price includes: Nightingale Modem, Commstar ROM pack, Cables & Comprehensive manual)

Nightingale Modem without software	**Only £99**
COMMSTAR ROM package only (P&P on modem £2.00)	**£29**
Auto Dial/Auto Answer Board	**£48**
Auto Dial Utilities Disc	**£9.50**
OBBS Bulletin Software	**£20.00**

Viglen Console Unit

Enhance the appearance and convenience of your BBC Micro with the Viglen console unit.

£42 (carr. £4)

BT TELEPHONE CONNECTORS

LJU 1/4A Mini Line Master	**£4.50**
LJU 1/6A Mini Line Slave	**£3.00**
LJU 2/4A Line Master	**£4.00**
LJU 2/6A Line Slave	**£2.50**
LJU 3/4A Flush Master	**£3.95**
LJU 3/6A Flush Slave	**£2.75**
LJU 10/3A Dual Splitter	**£5.50**
4 Way BT Plug	**£0.75**

Versatile **BEEB SPEECH SYNTHESISER** Unit

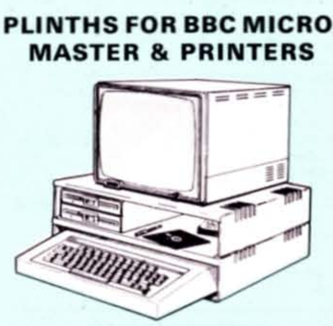
Beeb Speech Synthesiser

The Watford Speech Synthesiser is a very flexible speech synthesis unit based upon the powerful phonemes system. This system stores the building blocks of speech (called phonemes) and allows you to combine them quickly and easily to form virtually any word imaginable.

Supplied with an advanced ROM, you are provided with a 500 word dictionary to get you started. These can easily be added to by following the notes given in the comprehensive manual.

SPECIAL PRICE £32 (carr £2)

PLINTHS FOR BBC MICRO, MASTER & PRINTERS



Protect your computer from the weight and heat of your monitor. The BBC micro plinths have slots for maximum ventilation. The single plinth is suitable for a BBC and monitor, whilst the double height version provides enough room for our stacked or side-by-side dual disc drives or TORCH Disc pack, to be placed in the centre section. If you use our stacked drives, the remaining space can be used for further peripherals e.g. Speech Synthesizer, EPROM programmer or simply stationery. The computer slides neatly in to the lower section allowing easy access to remove the lid. The printer plinth is equally sturdy but without the cooling slots. It allows for access to the paper from the front as well as from the rear, (a facility not often thought of in similar products) if the paper is located beneath the plinth. This is a very convenient way to work especially if your work area is not deep enough to take the printer and paper separately.

SINGLE BBC PLINTH	**£11** (carr. £1.50)
DOUBLE BBC PLINTH	**£20** (carr. £2.00)
PRINTER PLINTH	**£10** (carr. £1.50)
SINGLE MASTER PLINTH	**£14** (carr £1.50)
DOUBLE MASTER PLINTH	**£25** (carr £2.00)

Continued →

COMPUTER CONCEPT'S ROMS

ACCELERATOR	£48
CARETAKER Basic Utility	£27
Graphics ROM	£23
Disc Doctor ROM	£24
TERMI	£27
COMMUNICATOR	£49
SPEECH ROM	£24
Printmaster	£24

Wordwise £25

Wordwise plus

£40

We are giving away absolutely **FREE,** the superb Word-Aid ROM worth £24, with every WORDWISE PLUS package bought from us.

Word-Aid

The most comprehensive utilities ROM for Wordwise-Plus

Extend the power of your Wordwise Plus word processor with this most advanced ROM from Watford. By utilising the powerful Wordwise Plus programming language, WordAid provides a whole host of extra features, all accessed via a special new menu option. This ROM has been personally approved by Mr Charles Moir, the author of WORDWISE PLUS.

- Alphabetical sorting of names and addresses.
- Text transfer options.
- Chapter marker.
- Epson printer codes function key option.
- Search and display in preview mode.
- Embedded command removal.
- Print Multiple copies of a document.
- Multiple file options for print and preview.
- Address finder.
- Label printer.
- Mail-merger.
- Number/delete/renumber.
- Clear text/segment area.
- BBC B, B+ and Master compatible.

Only **£24**

(N.B. Word Aid requires a Disc Interface in your Micro)

HI-WORDWISE-PLUS

Supplied on disc. This version requires a WORDWISE-PLUS ROM to be present in the machine. It gives up to 44k of text space on the 6502 2nd processor.

£5

Inter SHEET £40

INTER-CHART **ONLY: £26**

Computer Concepts' long awaited Inter-WORD Only: £49

Special price to Wordwise Plus owners. Please quote your reg. number and pay

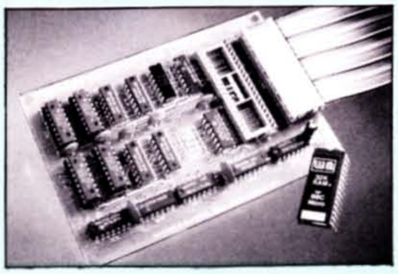
ONLY: £39

All Prices Exclusive of VAT

32K

SHADOW RAM-Printer Buffer

Expansion Board



A MUST FOR WORD PROCESSING

Watford Electronics now brings you the latest state-of-the-art MEMORY EXPANSION BOARD for your BBC microcomputer. Don't throw away your BBC B for a BBC B+ or BBC Master. Just plug the ribbon cable into the 6502 processor socket, and fit the compact board inside the computer. Immediately you will gain not 16K or even 20K, but a massive 32K of extra RAM!!!

- IMPROVE your WORD PROCESSING system, whether disc or cassette based. Don't wait for a slow printer – type in text while printing. TWO JOBS DONE SIMULTANEOUSLY and £100+ saved on a printer buffer.

- "VIEW" Wordprocessor users can now type in letters in 80 columns and have up to 28,000 bytes free – 5 times as much as normal.

- In WORDWISE (or WORDWISE-PLUS), preview in 80 columns with the full 24K of text in memory. This product is recommended as an ideal complement by Computer Concepts.

- Combine GOOD GRAPHICS and LONG PROGRAMS. Use the top 20K of the expansion RAM as the screen display memory, leaving all the standard BBC RAM free for programs. Benefit from MODE 0/1/2 graphics and 28K of program space.

- Use the FULL 32K or the bottom 12K of the expansion RAM as a PRINTER buffer for PARALLEL or SERIAL printers, sound channels, RS423 etc. Print large text files while running long graphics programs, and have all your buffer options available as well (*FX15,21,138,145,ADVAL etc). Please note only a 12K printer buffer can be used with Wordwise or Wordwise-Plus, due to the way they are written.

- Ensure COMPATIBILITY with a vast range of hardware (including our ROM board, the ATPL ROM boards, double density boards, second processors), and software (including BASIC, TOOLKIT, VIEW, WORDWISE (1.20+), WORDWISE-PLUS, Music 500's AMPLE). This is because our board, unlike those of our competitors, is connected to the computer by a ribbon cable and has the power consumption of a couple of ROMs!

- Achieve EASY OPERATION with ROM based software. A large range of commands is available for machine code and BASIC users, including some useful *HELP messages, and a comprehensive manual is supplied free.

- Unique facility to turn ROMs off and on again. Unlike all other ROM managers, this feature does not use 'unofficial' memory. Two bytes of normally user-inaccessible memory on the RAM card are used to ensure ROMs are disabled WHERE OTHER ROMS FAIL.

Only: £59 (carr £2)

(Price includes a comprehensive manual and the ROM)

INCREDIBLE WORD PROCESSING DEAL ! ! !

Watford Electronics, already renowned for quality products at discount prices, are offering, the truly spectacular BARGAIN OF THE YEAR!

A Watford's 32K RAM Card (offering printer buffering and shadow screen RAM facilities) with the well known WORDWISE PLUS Word processor.

32K Shadow RAM Card/Printer Buffer and Wordwise Plus (a very powerful package) for the absolutely astounding price of:

Only £75 (carr £2)

(P.S. For an extra £14, we will include Word-Aid ROM package for the Wordwise Plus, if bought at the same time.)

VIEW

VIEW WORDPROCESSOR 2.1 .... **£37**

VIEW 3.0 ROM

Price: Only **£56**

HI-VIEW

A special version of VIEW designed for use with 6502 2nd Processor. Available on disc, it offers 47K of text memory.

£36

VIEWSHEET (Acornsoft)	**£37**
VIEWSTORE	**£37**
VIEWSPELL	**£50**
VIEWPLOT Disc	**£25**

Watford's own Sophisticated VIEW PRINTER DRIVER for Epson FX80 & KAGA KP

Only £10

VIEW DRIVERS FOR JUKI & BROTHER HR15 PRINTERS

Only £10

VIEW/VIEW SHEET PRINTER DRIVER for SILVER REED

(Officially approved by Silver Reed)

Only: £10

OMNIREADER

OCR at a price you can now afford

The manually operated omnireader is preprogrammed to read 4 common type faces – including: KAGA Courier 10, Courier 12, Letter gothic & Prestige Elite. It reads a line of text in about 3 seconds & is ideal for inputting already typed material into wordprocessor packages, such as View or WW, Databases or Spreadsheets. Comes complete with power supply, instruction manual, longrule & Dustcover. Also available on disc for the BBC is a utility program which merges input from the service port with the keyboard thus allowing full editing control whilst using the omnireader. Also included is a Basic program which displays the pixel map image obtained from the omnireader – ideal for doing your own OCR.

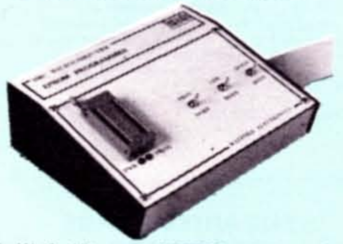
(As seen on the TV programme Micro LIVE)

Price: **£165**

BOOKS (No VAT on Books)

30 Hour BASIC (BBC Micro)	£7.95
40 Best machine Code Routines	£7.95
6502 Assembly Language Program	£19.95
6502 Application	£11.95
6502 Assembly Language Subroutines	£19.95
6502 Development System	£7.50
68000 Assembly Lang. Programming	£19.95
68000 Machine Code Programming	£12.95
68000 Programming the	£22.95
A User Guide to Wordwise Plus	£9.95
A Young persons Guide to BBC Basic	£5.95
Advanced Disc User Guide	£14.95
Advanced BASIC ROM User Guide	£9.95
Advanced Machine Code Technique for BBC	£7.95
Advanced Programming for the BBC Micro	£6.95
Advanced User Guide for BBC Micro	£13.50
Advanced Graphics with BBC	£9.95
Assembly Language Programming on BBC Micro	£11.50
Advanced Programming Techniques for the BBC Micro	£8.95
Adventure into BBC BASIC	£6.95
Applied Assembly Lang. for BBC	£9.95
Assembler Routines for the 6502	£7.95
Assembly Language Programming FOR the BBC Micro	£8.95
Assembly Language Programming on the BBC & Electron	£8.95
Basic Programming on the BBC Micro	£6.95
Basic ROM User Guide	£11.95
Basic User Guide for BBC Micro	£10.00
BBC B+ User Guide	£14.95
BBC BASIC	£5.95
BBC Forth	£7.50
BBC Machine Code Portfolio	£7.95
BBC Micro add on guide	£7.95
BBC Micro Advanced Reference Guide	£10.95
BBC Micro Advanced Programming	£9.95
BBC Micro Book BASIC Sound & Graphics	£7.95
BBC Micro ROM Book	£9.95
BBC Micro Disc Companion	£8.95
BBC User Guide	£10.00
BBC Wargaming	£8.95
BCPL User Guide	£14
Business Applications on BBC	£7.95
Complete FORTH	£6.95
CP/M - 86 User's Guide	£19.95
CP/M Bible	£16.50
CP/M Handbook with MPM	£9.95
CP/M Plus Handbook	£13.95
CP/M Soul of	£16.50
CP/M The software BUS	£8.95
Creative Animation & Graphics	£7.95
Creative graphics on BBC Micro	£7.50
Disc Drive Projects for Micros	£5.45
DISC FILING SYSTEM (DFS) Operating Manual for BBC	£6.95
Disc Programming Techniques	£9.95
Discovering BBC Micro Machine Code	£6.95
Disc System for the BBC Micro	£6.95
Exploring FORTH	£6.95
Filing System & Databases for the BBC Micro	£7.95
FORTH on the BBC Micro	£7.50
Functional Forth for the BBC Micro	£5.95
Graphics for Children	£6.95
Graphs & Charts on BBC Micro	£7.50
Guide to BBC ROM	£9.95
Hackers Handbook	£4.95
Hackers Handbook - New	£6.95
Handbook of Procedure & Functions for the BBC Micro	£6.95
Interfacing & Robotics on BBC	£15.95
Interfacing Your BBC Micro	£8.95
Into View	£4.50
Introduction to COMAL	£9.50
Introduction to LOGO	£6.95
Introducing 'C'	£9.95
Introducing CP/M on the BBC Micro Z80 2nd Processor	£9.95
Introducing LOGO	£5.95
Introduction to FORTH	£8.95
Introduction to PASCAL	£17.95
ISO -PASCAL Reference Manual	£9.95
Let your BBC teach u to program	£5.45
LISP 2nd Edition	£14.95
LISP, A Beginners Guide to	£10.95
Logo Programming	£9.95
Mysteries of DISC DRIVES and DFS REVEALED	**£5.95**
Mastering CP/M	£17.95
Master Advance Reference Manual	£19.95
Master Reference Manual Part 1	£14.95
Master Reference Manual Part 2	£14.95
Micronet Handbook	£6.95
Programming the 6502	£16.95
Programming the Z80	£19.95
Sencing & Control Projects for BBC	£5.95
S-PASCAL on BBC Micro	£7.50
Structured Basic	£7.95
Structured Prog. with BBC BASIC	£6.50
Termulator Manual	£4.95
The Complete FORTH	£6.95
The Complete Programmer	£5.95
The Epson FX/KAGA PRINTER Commands REVEALED	**£5.95**
Turtle Graphics on BBC Micro	£7.50
Using Floppy Discs with BBC Micro	£5.95
View Guide	£4.50
Viewsheet User Guide	£10
Using BBC Basic	£4.95
Wordstar & CP/M made easy	£7.45
Wordwise Plus Guide	£9.95
Z80 Assembly Language Programming	£19.95

EPROM PROGRAMMER



The Watford Electronics' EPROM programmer for the BBC micro is a high quality self contained package. Programs all popular EPROMs from 2K to 16K: 2716, 2516, 2532, 2564, 2764 and 27128. All manufacturers' specifications have been followed to program EPROMs at the correct speed – wrong timings could destroy your EPROMs. The unit has its own power supply so does not put heavy loads on the BBC power supply as do some other units. Connects directly to the 1MHz bus following all Acorn recommendations on addressing and bus loadings.

SOFTWARE PACKAGE
The software is supplied on an EPROM which plugs into the Micro and is instantly available with a single command (no time wasting as on Cassette/disc loading). It is a fully purpose designed and ingegrated package to simplify ROM development. The system is menu driven with many prompts to avoid any accidents.

Software facilities include:
Load File – Save File – Down Load EPROM – Program EPROM – Verify – Blank Check – Editing of memory contents prior to programming.
Also included is an automatic system to allow Basic programs to be put in EPROM and accessed through the *ROM filing system. More than one program may be put in an EPROM. All these facilities and more are explained in the comprehensive and clear 15 page manual.

SPECIAL OFFER £69 (£3 carr.)

TEX EPROM ERASERS

EPROMs need careful treatment if they are to survive their expected lifetime. Over erasure of EPROMs very rapidly turns them into ROMs! The TEX erasers operate following the manufacturers specifications to give the maximum possible working life by not erasing too fast. We use these erasers for all our own erasing work.

- **ERASER EB** – Standard version erases up to 16 chips. **£28** (carr £2)
- **ERASER GT** – Deluxe version erases up to 18 chips. Has automatic safety cut-off to switch off the UV lamp when opened. **£30** (carr £2)
- Spare UV tubes. **£9**

BEEB VIDEO DIGITISER

Using any source of composite video (colour or monochrome) and the Watford Beeb Video Digitiser, you can convert an image from your camera into a graphics screen on the BBC Micro.

This uses the full graphics capacity of the BBC micro in modes 0, 1 or 2. The video source may be a camera, video recorder or television, and is connected via the video output socket.

Images produced can be compressed, stored to disc, printed on an Epson compatible printer, directly used to generate graphics, analysed for scientific and educational use or converted to other formats e.g. Slow Scan TV or receiving a picture from a remote camera using a modem.

The output from the digitiser exactly matches the graphics capability in each mode, with up to 8 levels of grey in mode 2. The unit connects into the User Port and automatically scans a complete picture in 1.6 seconds.

Both the black and white levels can be adjusted manually for the optimum picture, or switched to automatic for unattended use. The image produced can be reversed if necessary.

Full controlling software is supplied on a normal sideways ROM and this is easily accessed via additional * commands. The package is designed to allow easy input of complex screens and give full access of the data to the user. Once on the screen, the image can be used as a normal graphics screen, allowing any of the usual graphics commands in BASIC or other ROM's to work on it.

A special print dump routine is included with the driver programs. This is specially designed to produce a fast, correctly proportioned picture, with reduced "contouring", resulting in an accurate reproduction of the original image.

Detailed examples of driving this unit from BASIC or other languages are all provided in the extensive manual supplied.

£110 (Carr. £3)

(Price includes: Digitiser Unit, Software in ROM & a Comprehensive Manual)
(BBC B+ and Master compatible, except Master with Econet)

Magazine Maker

(As seen on TV)

A combination of the AMX Pagemaker and Watford's Beeb Video Digitiser.

Using any video that provides a composite signal and the digitiser, images from a camera or TV can be converted into a graphics screen on the BBC Micro.

They can then be used within AMX Pagemaker to illustrate magazines or newsletters – in fact anything that needs to be created on A4 size paper.

With Pagemaker's many features, a variety of pictures can be composed – the only limit being the imagination.

Pictures can be doctored using Pagemaker's graphics option to produce any number of effects.

Text can be formatted around the digitised photo on screen using the facilities available, which include 16 typefaces, character and pattern definer, text formatting and the ability to load in wordwise and viewfiles plus much more.

Once created the picture can be printed out.

The Magazine Maker is suitable for any use that requires illustrated documents.

Complete Package **£129.00** (carr. £3)

Continued →

ARIES CORNER

Aries Computers was the first company to commercially market what is now known as SHADOW RAM. As part of it's continued expansion policy, Watford Electronics is proud to announce that the Aries range is now available exclusively from Watford Electronics and their dealers.

The Aries range, designed by experts offers you the solution to your upgrade nightmares. All the Aries products are compatible with double density disc controllers, modems, second processors, ECONET, hard discs, EPROM programmers and of course, other members of the Aries family and most of the much wider Watford family (some products advertised here perform identical functions and hence cannot be used together). Several major companies now test all their products to ensure compatibility with the Aries B20 & B32.

In quality of construction, the Aries range sits alongside the Watford range in setting a standard against which others are judged. Custom made connectors eliminate the damage to the BBC machine caused by inferior products.

The Aries B-32
Shadow RAM Card

18 months of intensive research and development have produced a worthy successor to the widely acclaimed Aries-B20; the revolutionary Aries-B32. This 'second generation' expansion board features 32k of RAM and a 16k ROM socket.

Like the BBC B+, the B32 provides 20k of shadow screen RAM and 12k of sideways RAM. Unlike the B+, the B32 has simple software commands which allow the user to reconfigure the RAM as 16k of shadow RAM and 16k of sideways RAM, or all 32k as sideways RAM.

With the B32, the programmer gets up to 28k of RAM available for Basic, Logo, Comal, Forth, Lisp and BCPL programs in any screen mode. The business user gets extra memory for View, ViewSheet, Wordwise Plus and many othr applications. For advanced applications, the scientific user gets access to a massive 47k of data storage using the Acorn approved *FX call.

Sideways RAM enables you to load sideways ROM images from disc, allowing you to have a large library of sideways ROMs (subject to the copyright holder's permission) stored on disc. The B32's sideways RAM can also be used to extend any operating system buffer (such as the printer buffer) or to load tape programs into a disc system.

The B32 simply plugs into the processor socket on your BBC micro – no flying leads to connect and no soldering. Provision of the on-board ROM socket means that the Aries-B32 control ROM does not use up one of your existing ROM sockets.

Price: B-32 **£80** (carr. £2)

Aries B-12
Sideways ROM Board

This board is extremely well made, simple to install, reliable when fully loaded and compatible with the Aries B-20 and the Aries B-32. For the business user or educationalist, the compact and secure internal fitting is ideal, with the ROM board tucked neatly inside the lid where it will not cause overheating problems. The serious software developer and the hobbyist may prefer to mount the board externally, giving instant access to the sockets for experimental purposes. A zero-insertion force (ZIF) sofket may be fitted to the board to enhance this mode of operation.

The B12 provides a total of twelve sideways ROM sockets (the four in the original machine are replaced by the twelve on he board), all fully accessible by the MOS sideways ROM system. In addition, there are two sockets for sideways RAM, giving up to 16k of RAM using 6264 static RAM chips.

The B12 system consists of two parts: a large detachable 'mother board' which carries the extension ROM sockets and a small 'base board' on a short ribbon cable, which plugs into the existing sideways ROM sockets. This two-board design eliminates the reliability problems previously associated with some other ribbon-cable based systems.

If you do not have an B32 or B20, a small adaptor module (the Aries B-12C) is available at a nominal cost. The 6264 static RAM chips used to provide the sideways RAM are advertised elsewhere in our advert.

Price:
Aries B-12 **£40.** Aries B-12C **£5**

THE ARIES B-488 IEEE-488 INTERFACE UNIT

The Aries-B488 is an interface unit to enable the BBC micro to control and monitor IEEE-488 bus systems. The IEEE-488 bus (also known as the 'GPIB' or 'HP-IB') is the standard method of interconnecting programmable laboratory instruments and control equipment. Using the B488, up to 15 devices may be connected in a single high-speed data network.

Aries B-488 Unit: **£238** (Carr £3)

THE ARIES RANGE HARDWARE REQUIREMENTS

Aries B-32 – BBC B, MOS 1.20, hardware plugs into CPU socket.
Aries B-12 – BBC B, MOS 1.20, hardware plugs into all four sideways ROM sockets and connects to the B32 or the B20. The adaptor Aries B-12C module is necessary where these are not fitted.
Aries B-488 BBC B, MOS 1.20, Hardware plugs into 1MHz Bus.

CREDIT CARD 24 HOUR
Ansaphone Hot Lines
(0923) 50234/33383

النور

ARABIC ROM
for the BBC Micro

The ALNOOR ARABIC ROM converts your BBC into a bilingual computer. New keytops provide both English and Arabic symbols. Two sets of Arabic symbols are provided for use in either context sensitive or insensitive operation.

20, 40 and 80 column operation. Compatible with ASMO (449). English/Arabic printer interface software. Numeric entry from either left or right of number. Communications software to send or receive 7 or 8 bit data.

Different shapes of Vowels (e.g. Shadda, Fatha, etc). Different shapes of Hamza. Full English and Arabic character sets with all special characters.

£85

(Price includes Alnoor ROM, Operating Manuals & a full set of Arabic/English Keytops)

OFFICE MATE

Database – Set up a computerised "card index" system and add record/data to the file your way. Features include search, sort, mathematical calculations, printer routines, data summaries, etc.

SPREADSHEET – Offers a wide range of invaluable calculation and editing features. Beebplot will take files created by Beebcalc to provide data portrayal in graph, histogram or pie chart format.

BEEBPLOT – Provides an easily assimilated visual representation of numerical data.

WORDPROCESSOR – Provides many routines found in large and expensive packages.

OFFICE MATE Only £10
(Cassette or Disc)

OFFICE MASTER

CASHBOOK – A complete "Stand Alone" accounting software package for the cash based sole trader/partnership business. It is designed to replace your existing cashbook system and will provide you with a computerised system complete to trail balance.

FINAL ACCOUNTS – Will take data prepared by the Cashbook module and produce a complete set of accounts as following: Trial Balance with inbuilt rounding routine; Notes to the accounts; VAT Summary; Profit & Loss A/C; Balance Sheet.

MAILIST – A very versatile program. Enables you to keep records of names and addresses and then print, examine, sort and find them, all with special selection techniques.

EASILEDGER – A management aid software tool designed to run alongside an existing accounting system. Essentially a Debit/Credit ledger system which can handle sales, purchase and nominal ledger routines to provide instant management information.

INVOICES & STATEMENTS – Greatly reduces the time and cost of preparing Invoices and Statements by storing essential information like customer names, addresses and account numbers. Has VAT routines and footer messages facility.

STOCK CONTROL – Allows you to enter stock received, stock out, summary of stock items and current holdings together with details of total cost, total stock value, current gross margin, cost of bringing stock to minimum level, units in stock ordering, quantity and supplier detail.

All this for only **£21**
(Cassette or Disc)

Money Management

This disc based software allows individual transactions to be stored and retrieved for upto 5 Bank a/c and 5 Loan accounts.

Price: Only **£11**

L.B.O. Rom
Life & Business Organiser

Use LBO to organise your life from today until 1999! It can handle literally hundreds of multi-line messages, as many as you are ever likely to need. Despite the very wide range of facilities offered, this professional program is VERY easy to use and requires absolutely NO knowledge of computers. A vital aid to your everyday life, LBO is GREAT FUN TO USE!

Price only: £17

D D D Suite Integrated Software System

-BASE **£15**
-CALC **£15**
-PLOT **£15**
COMBO PACK All 3 together **£36**

VOLTMACE JOYSTICKS

Delta 3B Single Joystick	**£10**
Delta 3B Twin Joysticks	**£16**
Delta 14B Single Joystick	**£12**
Delta 14B/1 Adaptor Module	**£12**
Transfer Software Disc/Tape	**£7**

ROM EXTRACTION TOOL

This extremely useful tool allows you trouble free chip removal from your computer by distributing the removal force over the whole body of any 24 or 28 pin chip.

Price: **£2**

SURGE PROTECTOR Plug

Fitted in place of your normal mains plug, this device protects your equipment against mains surges. Nearby lightning strikes, thermostats switching and many other sources put high voltage transient spikes on to the mains. This can lead to data corruption in memory and on disc and can result in spuriously crashing machines. A must for every computer user.

Protection for only **£8.75**

Replacement FLEXIBLE KEYBOARD CONNECTOR

£3

ATTACHE CARRYING CASE for BBC Micro

The Attache carrying case is attractively finished in mottled antique brown leatherette. The case is made of tough plywood, providing a very solid and safe way to carry your BBC micro. There is room provided to fit all the leads necessary behind the computer and manuals in the front. Locks supplied with two keys. Price **£13** (£2 carr.)

28 pin ZIF SOCKET (Textool) **£6.95**

28pin DIL HEADER PLUG

SOLDER type	**£1.50**
IDC CRIMP type	**£1.95**

SPARES for BBC Micro

Keyboard	**£46**	Keystrip	**£2**
UHF Modulator	**£4**	Case	**£25**
Speaker Grill	**£1**	Speaker	**£2**
Power Supply	**59**	Keyswitch	**£1.50**

8way DIP SWITCH **£0.85**

CONNECTING LEADS

(All ready made and tested)

CASSETTE LEADS 7 pin DIN Plug

to 5 pin DIN Plug + 1 Jack Plug	**£2.00**
to 3 pin DIN Plug + 1 Jack Plug	**£2.00**
to 7 pin DIN Plug	**£2.50**
to 3 Jack Plugs	**£2.00**
6 pin DIN to 6 pin DIN Plug (RGB)	**£2.50**

DISC DRIVE POWER LEADS

Supply from BBC power supply to standard Disc Drive connector.

Single **£3.00** Dual **£3.75**

DISC DRIVE INTERFACE LEADS

BBC to Disc Drives Ribbon Cable

Single **£4** Twin **£6**

MISCELLANEOUS CONNECTORS

	Plugs	Sockets
RGB (6 PIN DIN)	30p	45p
RS423 (5 pin Domino)	40p	50p
Cassette (7 pin DIN)	25p	65p
ECONET (5 pin DIN)	20p	30p
Paddles (15 pin 'D')	110p	215p
BBC Power Plug 6 way	80p	–
Disc Drive Plug 4 way	75p	–
BBC Power Socket 6 way	80p	–

Watford Electronics' Dealer's List

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Akhter House
Perry Road, HARLOW
Essex

Citkit Distribution Ltd
Park Lane, Broxbournea
Herts.

Dennis Spitz Computers Inc
86 Golders Green Road
London NW11

DMS, 2 Budgies Close
Taunton, Somerset

Greenbank Electronics
92 New Chester Road
New Ferry, Wirral
Merseyside

Gemini Marketing Ltd
Exmouth
Devon

Microman Computers
Rainford Industrial Estate
Mill Lane, Rainford
St. Helens

Twillstar Computers Ltd
Apex House
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Southall

Verospeed Ltd
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Hants.

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483 Centre Road, Bentleigh
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Alpha Computer Co
Shop 314 Chi Fu Commercial Centre
Chi Fu Fa Yuen, Hong Kong
Tel: 5-506592

ECD BV, Voldersgracht 26
2611 EV Delft
Holland

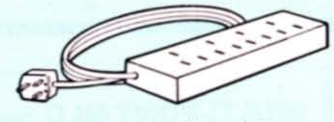
Scientex P.V.B.S.
Zilversmidstraat 2
B-2000 Antwerpen, Belgium
Tel: 03 233 59 06

Techno-Matic Data
Holbergsgade 19
1057 København K
Denmark

Velobyte, Scheaedyksadyk 5A
3011 EB Rotterdam
Holland
Tel: 4138197

Viking Tecno, Vestergade 12.1
9620 Aalestrup, Denmark
Tel: 08 642522

4 WAY MAINS DISTRIBUTION SOCKET



4 way top quality mains trailing sockets. Supplied wired up with mains plug ready for use. Can be screwed to floor or wall if required. Very useful for tidying up all the mains leads from your peripherals. Allows the whole system to be switched on from one plug.

£9.50 (carr £1.50)

ACORN MUSIC 500

The Acorn Music 500 System is probably the most powerful piece of music generating hardware available for the BBC Micro.

£72 *(carr £4)*

Software Disc 'Mu-500'
has 13 tunes **Only: £6**

CHIP SHOP

8271	**£36**
DS3691	**£3.50**
DS88LS120	**£3.00**
LM324	**£0.45**
SN76489	**£5.50**
SAA5050	**£8.75**
UPD7002	**£4.40**
2764-250nS	**£2.00**
27128-250nS	**£2.50**
27512	**£18**
4013	**60p**
4020	**£0.90**
4464	**£8**
4816 RAM	**£1.00**
6264LP-8K RAM	**£3.00**
6502A CPU	**£5**
65C02 CMOS	**£10.00**
65C12	**£9**
6512A	**£10.00**
6522	**£3.40**
6522A	**£5.00**
6845SP	**£6.00**
7438	**40p**
74LS00	**25p**
74LS04	**25p**
74LS10	**25p**
74LS123	**80p**
74LS163	**70p**
74LS244	**80p**
74LS245	**£1.00**
74LS373	**£1.00**
74LS393	**£1.00**

ASSORTED ROMS

ACORN BASIC 2	**£19**
ACORN ADFS	**£25**
ACORN DNFS	**£17**
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Acorn OS B+	**£25**

Acorn BCPL	**£42**
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BROM	**£28**
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Acorn LOGO	**£42**
ISO Pascal	**£42**
ISO-Pascal Stand Alone Generator	**£30**
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Help II	**£27**
Mini Office II	**£14.50**
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View 3.0	**£56**
Hi-View	**£36**
Viewsheet	**£37**
Viewstore	**£37**
Viewspell	**£50**
Viewplot Disc	**£25**

ACORN'S GRAPHICS EXTENSION ROM
GXR-B £21.00 GXR-B+ £22.00

Prices subject to change without notice and available on request. All offers subject to availibility.

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SHOP HOURS: 9.00am to 6.00pm. Monday to Saturday. Thursdays 9am to 8pm. (Ample Free Car Parking Spaces)

Specifications of all products are given in good faith but are subject to change without notice. Some items vary in their availability. Please ring for latest delivery situation.

Watford Electronics

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Telephone: (0923) 37774; Telex: 8956095 WATFRD
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Ring for a leaflet on our new range of exciting software.

ALL CJE MICRO'S SOFTWARE IS B, B PLUS & MASTER COMPATIBLE.

MULTI-FONT NLQ for the BBC

NEW!

Converts most printers to NEAR LETTER QUALITY in user definable Fonts.

For EPSON & EPSON Compatibles, including MX/RX/FX/LX 80/100, STAR DP510/Gemini 10X/SG10/NL10 & Citizen 120D.

Simple to use, standard EPSON codes for Underline and Doublewidth used.

Multi-Font NLQ comprises of MFNLQ ROM for the BBC, and utility disc containing the FONT definer, ten fonts, BASIC demonstration program, VIEW demo text file and Driver.

After initialising Multi-Font NLQ with a 'MFNLQ' Multi-Font NLQ is normally transparent to the user. Multi-Font does claim some memory for workspace and storing font data.

Multi-Font NLQ is compatible with nearly all software, including most BASIC programs, VIEW, WORDWISE & InterWORD (SCRIBE & Printer Buffer software currently not supported).

Ten fonts are supplied or use the included font definer to create your own.

Fonts included:- Standard NLQ, Courier, Italic, Gothic, CompTS, Bold, Shadow, Outline, Broadway E. and Theatre.

Additional Font Disc MF 'B' contains:-

Hand, Script, Stencil, Broadway, Caps, Italic-Plain, Meccano, Plain, STD large, Wire and Inverse.

For Canon & Taxan Kaga users we recommend FONTAID in preference to Multi-Font NLQ.

Multi-Font NLQ (ROM and 40/80 Disc)	**£30.00**
Additional font disc 'MF-B' (11 fonts)	**£15.00**
P & P on MFNLQ	**£1.00**

This is Standard
This is COURIER
This is ITALIC
This is GOTHIC
This is COMPTS
This is BOLD
This is SHADOW
This is OUTLINE
This is BROADWAYE
This is THEATRE

EXAMPLE OF MFNLQ FONTS

FONTAID for the BBC

ENHANCED!

NLQ Definer for Canon & Taxan Kaga NLQ Printers.

Design your own NLQ Fonts or 'download' one of our 40+ predefined fonts.

Fonts can be downloaded within Wordwise, Inter Word or VIEW Documents allowing different fonts to be used for different paragraphs, or even individual lines of text. During downloading your Program or Text will not be corrupted.

On the FONTAID standard font Disk are the following eight fonts:- Square, Outline, Italic, Gothic, Computer Type Style, Bold, Shadow, and Broadway Engraved.

Additional disc 'A' gives an extra 11 fonts including:-
Greek/Maths, Plain, Hand & (Elite, Condensed, & Super Condensed).

Now included is a facility to issue '*' commands within a VIEW document. To download new fonts within VIEW documents, the FONTAID ROM needs to be fitted in the BBC. (All other FONTAID facilities are available on both the FONTAID ROM & DISC). Fonts are always downloaded from Disc.

Fontaid is recommended to Canon & Taxan Kaga owners in preference to Multi-Font NLQ. As downloadable NLQ is a built-in facility of the Printer, full access to all the printers control codes is still allowed. The resolution of the FONTAID NLQ is also slightly higher than that of Multi-Font NLQ.

FONTAID requires 6264 RAM chip in printer.

FONTAID ROM & STD Font disc	**£30.00**
FONTAID ROM & STD Font disc with 6264 RAM	**£36.00**
FONTAID Additional Font DISC 'A' 11 fonts	**£15.00**
FONTAID Additional Font DISC 'B' 13 fonts	**£15.00**

ROMS of individual fonts are available and can be used with any computer.

FONT ROMS	**£18.00**
P & P on FONTAID	**£1.00**

INFORM

A UNIQUE NEW POWERFUL USE FOR SIDEWAYS RAM

NEW!

INFORM has been developed specifically to take full advantage of the Sideways RAM facility that many BBC micro users now have. Inform is compatible with most SIDEWAYS RAM units including ATPL Sidewise with RAM, Solidisc SWR, BBC B PLUS 128K & BBC MASTER series.

INFORM is a very powerful facility, which allows the user to display text information, of any kind, from Sideways RAM. This information can be readily accessed by using *I commands from the keyboard or from application programs. In this way, much information can be displayed on the screen without stopping the current task, such as entering text in WORDWISE or VIEW.

The information in the RAM can be changed dynamically at any time.

A help manual can be created for your application, so that a reminder about more obscure points can be given to order.

Address and/or telephone numbers can be held and displayed quickly even while other applications are running. Very useful if you need to quickly display information about a client while he is hanging on the end of a phone!

Current prices for your products or stock position can be recalled instantly and readily modified using a wordprocessor. Similar files may be created from most databases such as VIEWSTORE.

In fact, any information that you constantly refer to can be displayed immediately without running another program. Your use of INFORM is only limited by your imagination, as they say!

There are three Inform Data Files (I.D.F.), of often used information, supplied on the disk to give an indication of the use of INFORM.

INFORM on 40/80 track disc. P&P £1.00 **£20.00** inc. VAT.

To use INFORM you must have Sideways RAM.

PRINTERS

NOW FREE DELIVERY on PRINTERS (by courier)

Ring for sample printouts, full specification and latest prices.

Near Letter Quality Printers all with Centronics interface, Friction and Tractor feed.

Taxan Kaga KP810	**£260.00**
Canon PW1080A	**£270.00**
Canon PW1156A (15" printing)	**£414.00**
Citizen 120D	**£180.00**
JUKI 5510	**£260.00**
JUKI 5520 7 NLQ Colour Printer	**£430.00**
Letter Quality Printer	
JUKI 6100 Daisywheel (20 C.P.S.)	**£340.00**
BBC Cable	**£8.00**

Inclusive of VAT & Delivery Ring for latest prices.

CJE BBC Printer PACKS include:-
CABLE to BBC 1.25M, M/C two tone screen dump, Screen text dump, Function key set up program, Function key label printing program, VIEW driver, Character defining program for downloadable character set (draft mode), 100 sheets of paper, Mains plug with 3AMP Fuse, Booklet giving instruction on pack software and general details of using the printer with a BBC.

C.J.E. BBC Printer Packs are £15.00
(e.g. CANON PW1080A with Printer pack £270 + £15 = £285 everything included)
CJE Printer Pack software is normally provided on cassette.

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VAT included where appropriate.
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C.J.E. MICRO'S (Dept. MU8)
78 Brighton Road
Worthing W. Sussex
BN11 2EN (0903) 213361

Full range of Printer and BBC, AMSTRAD & ATARI accessories available. Offical ACORN approved Dealer.

CJEmicros

ADI takes ADT a few steps further

Product: Advanced Disc Investigator
Price: £28.75
Supplier: Advanced Computer Products,
6 Ava House, High Street, Chobham,
Surrey GU24 8LZ. Tel: 0276 76545

JIM NOTMAN reviews the Advanced Disc Investigator

MANY people will know Advanced Computer Products for its excellent Advanced Disc Toolkit – reviewed in *The Micro User*, February 1986. ADI is designed to complement and extend the functions of ADT.

Like ADT, ADI is compatible with the 6502 second processor and shadow screen of the B+, as well as both the 8271 and the 1770 floppy disc controllers.

There are limitations imposed, depending on which FDC you have in your machine. The 1770 can do some things the 8271 cannot do and vice versa. To get the best of both worlds it is possible to have a disc interface with both controllers present.

A few words of warning – if you have a 1770 interface that is not from Acorn check that the memory addresses of the FDC and the drive number latch are the same as the Acorn interface, otherwise you cannot expect compatiblity.

The main display is in Mode 0, so a reasonably good monitor is needed to be able to read the 80 column screen clearly. An ordinary colour TV is certainly not adequate.

The Mode 0 screen also requires a lot of memory, so if you have fitted an Acorn type 1770 interface to your BBC Model B you may run into memory problems with the 1770 in double density mode, unless you also have shadow screen RAM.

This problem also occurs with the Tube because the buffer used as workspace needs to be kept in the I/O processor. ACP says that ADI is not intended to operate in sideways RAM – it will work in the Electron however.

ADI has a number of new *HELP options (see Figure I)

```
ADI
FDC
RESULT
TRACK
```

*Figure I: *HELP ADI*

- *HELP FDC (Figure II) – displays all the 8271 commands available, but only those commands marked with a star can be used on a 1770 FDC.
- *HELP RESULT (Figure III) – gives the meanings of all the error messages given by the FDC.
- *HELP TRACK (Figure IV) – shows how the tracks are formatted to Acorn standards for both single and double density modes.
- *HELP ADI – shows the two new star commands offered by ADI.

*OSWORD7F allows commands to be sent directly to the FDC. The parameters following the command will

→

Command	Operation	Parameters
&35	Specify Command	
	Define Drive Characteristics	&0D, Step Rate, H/S Time, H/L Time
	Define Bad Tracks Drive 0	&10, 1st Track, 2nd Track, Track
	Define Bad Tracks Drive 1	&18, 1st Track, 2nd Track, Track
&40	Scan Sector	Track, Sector, L/N, T/S, Length
&44	Scan Deleted Sector	Track, Sector, L/N, T/S, Length
&4A	Write Sector	Track, Sector
*&4B	Write Multiple Sectors	Track, Sector, L/N
&4E	Write Deleted Sector	Track, Sector
*&4F	Write Multiple Deleted Sectors	Track, Sector, L/N
&52	Read Sector	Track, Sector
*&53	Read Multiple Sectors	Track, Sector, L/N
&56	Read Deleted Sector	Track, Sector
*&57	Read Multiple Deleted Sectors	Track, Sector, L/N
*&5B	Read Track ID	Track, 0, Field Count
&5E	Verify Deleted Sector	Track, Sector
&5F	Verify Multiple Deleted Sectors	Track, Sector, L/N
*&63	Format	Track, Gap 3, L/N, Gap 5, Gap 1
*&69	Seek	Track
&6C	Read Drive Status	
*&7A	Write Special Registers	
*&7D	Read Special Registers	
	Scan Sector Number	&06, Data
	Scan Block Number	&14, Data
	Scan Byte Count	&13, Data
	* Current Track Register Drive 0	&12, Data
	* Current Track Register Drive 1	&1A, Data
	Output Port	&23, Data
	Bad Track Register 1 Drive 0	&10, Data
	Bad Track Register 2 Drive 0	&11, Data
	Bad Track Register 1 Drive 1	&18, Data
	Bad Track Register 2 Drive 1	&19, Data
*&E0	Read Track (1770)	Track
*&F0	Write Track (1770)	Track

*Figure II: *HELP FDC*

n Page 49

iliar to anyone who has used an
d &7F call from Basic or machine
*OSWORD with no following
eters returns the result of the last
ORD7F sent to the FDC.

I enters the investigator screen,
s designed to look rather like a
disc in its sleeve (see Figure V).
ands are entered from a menu
in the top left hand corner of the

nitial letters of each command
layed. Pressing the left and right
keys will move the cursor
the commands. As it does so
l letter is highlighted and the full
the command is displayed on
below.

lect a command either press
when the command is high-
or press the corresponding
d letter.

bottom of the screen there is a
indow where numerous par-
re displayed. The active box is
lighted in reverse video. To
different box press Shift and
right cursor keys.

arameters include the current
isc density and the track and
umbers, but some of the
n needs decoding.

nple, in the box highlighted in
FM refers to single density
FM for double density mode

Ieaning
uccessful Completion
can Comparison Found
can Range Found
ot Used
ock Error
te DMA
Field CRC Error
ta Field CRC Error
ive Not Ready
sc Write Protected
ck 00 Not Found
ite Fault
tor Not Found
Used
Used
Used
eted Data Found

LP RESULT

Field	FM		MFM	
	Value	Length	Value	Length
Sector ID Field	–&FF –&00	P 6–	–&4E	P
Post Index Field Gap (1)			–&00 –&A1	12 3
ID Address Mark	–&FE	1	–&FE	1
T/ID	–Track	1	–Track	1
H/ID	–Head	1	–Head	1
S/ID	–Sector	1	–Sector	1
L/ID	–Length	1	–Length	1
CRC	–CRC	2	–CRC	2
Post ID Field Gap (2)	–&FF –&00	11 6	–&4E –&00 –&A1	22 12 3
Data Field				
Data Address Mark	–&FB	1	–&FB	1
Data Bytes	–Data	Sector	–Data	Sector
CRC	–CRC	2	–CRC	2
Post Data Field Gap (3)	–&FF –&00	P 6	–&4E	P
Final Gap (4)	–&FF	–	–&4E	–

*Figure IV: *HELP TRACK*

– and 96 refers to the number of tracks per in (TPI).

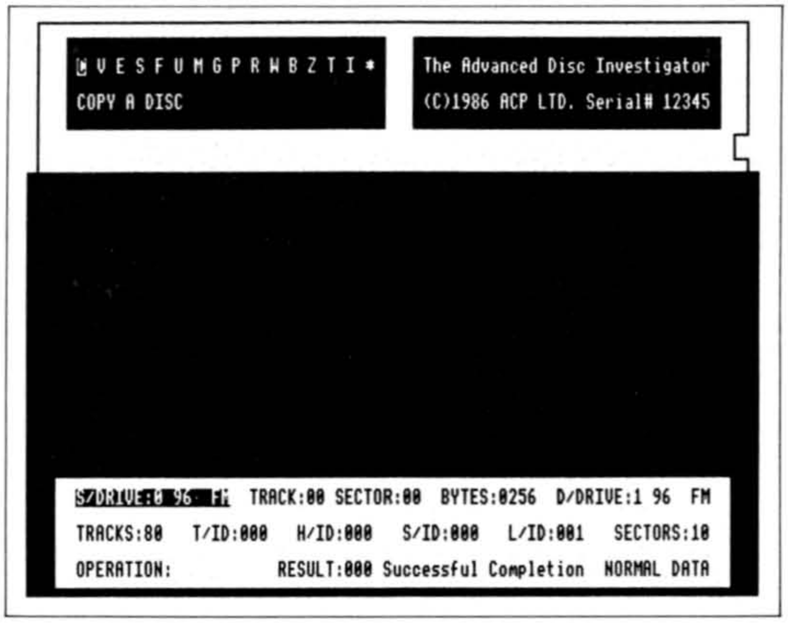
If you have a 40 or 80 track disc drive leave the setting at 96 TPI. Only if you want to read and write to a 40 track disc on an 80 track drive should this setting be changed to 48 TPI.

Individual parameters are altered first by selecting the correct box, then using the Ctrl key with the up or down cursor key to cycle through the various options displayed.

The commands entered at the top of the screen are:

Copy a disc copies tracks from one disc on to another. This will include the format of the source disc, so that the destination disc does not need to be

→

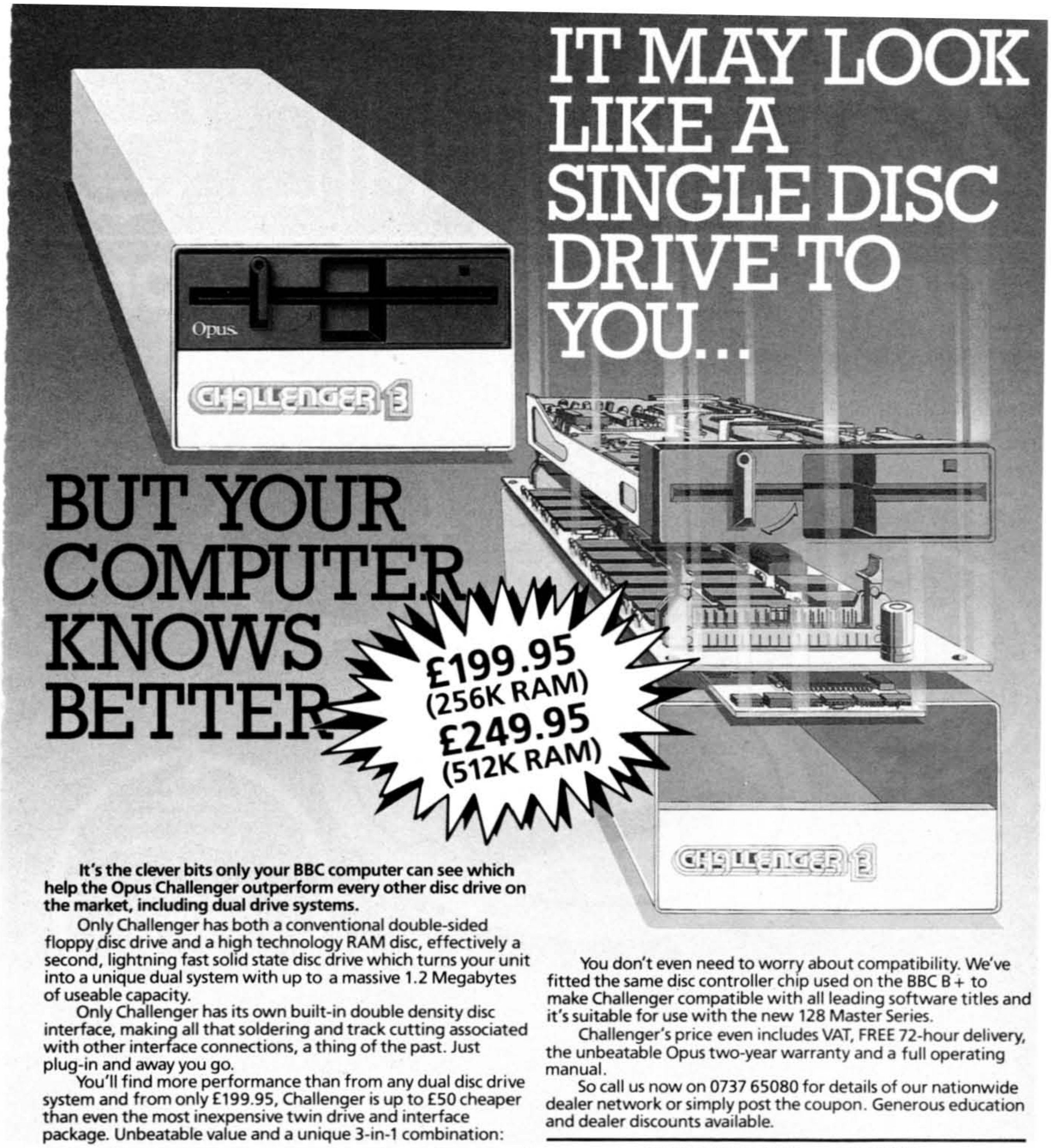


```
W V E S F U M G P R W B Z T I *        The Advanced Disc Investigator
COPY A DISC                            (C)1986 ACP LTD. Serial# 12345

S/DRIVE:0 96 FM  TRACK:00 SECTOR:00  BYTES:0256  D/DRIVE:1 96  FM
TRACKS:80   T/ID:000   H/ID:000   S/ID:000   L/ID:001   SECTORS:10
OPERATION:           RESULT:000 Successful Completion  NORMAL DATA
```

Figure V: Investigator screen, copy a disc

IT MAY LOOK LIKE A SINGLE DISC DRIVE TO YOU...



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formatted. This will also copy many, but not all non-standard discs.

Verify a disc compares two discs to see if they are the same. This is especially useful after the **Copy a disc** command.

Edit a sector gives more than you'd expect from a standard sector editor. You are able to step through different sectors and tracks easily with the cursor keys.

When editing keyboard input can be in Ascii or hexadecimal. Sectors may also be displayed as a 65C02 disassembly and there is an option to print the screen on to a printer.

Scan a disc displays the sector header information block with its track, head and sector numbers and the sector length – see Figure VI.

Normally the process will continue from the first track specified till it has displayed all the tracks required. By pressing any key the display will be paused until another key is pressed.

Format a disc formats or reformats specified tracks of the disc. This does not replace a standard disc formatter because even when the whole disc is formatted ADI does not write any directory information.

Unformat a disc formats tracks in such a way that the FDC is unable to distinguish any sectors on the track, just like a blank track.

Modify format parameters allows you to have control over the way the disc is formatted. Only about 75 per cent of the space on a track is used for data. The other information is vital for the FDC to know where data should be written and to be able to identify each individual sector.

Get sectors from disc reads a number of sectors into the buffer workspace.

Put sectors to disc writes a number of sectors from the buffer on to disc.

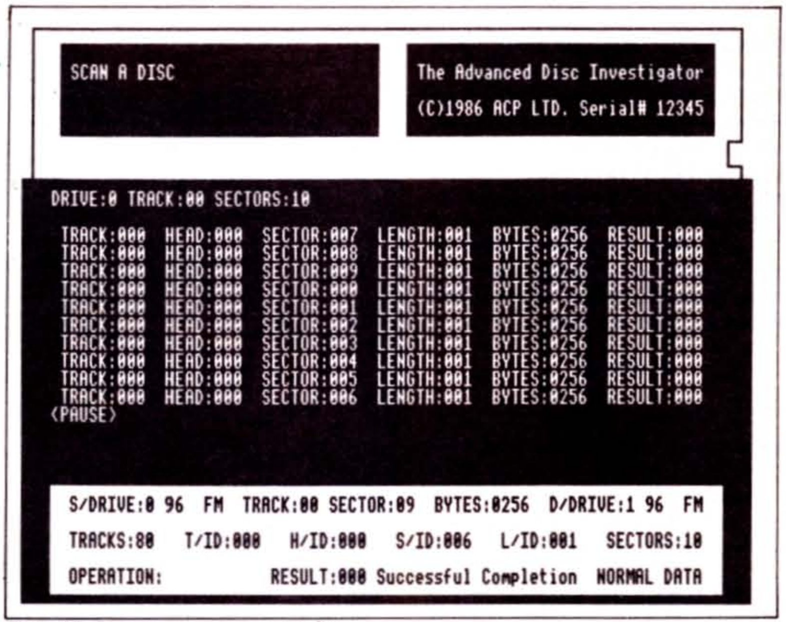
Read track data will read all the bytes on a track. This can only be fully implemented with a 1770 FDC.

Write track data writes the buffer on to the whole track of a disc. Like read track this can only be done with a 1770 FDC.

Buffer examine allows the data to be displayed and edited without placing information from the disc into memory.

Zero buffer clears the buffer, so that every byte is set to zero.

Turn printer on/off allows the central display area of the screen to be duplicated on a printer.



```
SCAN A DISC                  The Advanced Disc Investigator
                             (C)1986 ACP LTD. Serial# 12345

DRIVE:0 TRACK:00 SECTORS:10

 TRACK:000  HEAD:000  SECTOR:007  LENGTH:001  BYTES:0256  RESULT:000
 TRACK:000  HEAD:000  SECTOR:008  LENGTH:001  BYTES:0256  RESULT:000
 TRACK:000  HEAD:000  SECTOR:009  LENGTH:001  BYTES:0256  RESULT:000
 TRACK:000  HEAD:000  SECTOR:000  LENGTH:001  BYTES:0256  RESULT:000
 TRACK:000  HEAD:000  SECTOR:001  LENGTH:001  BYTES:0256  RESULT:000
 TRACK:000  HEAD:000  SECTOR:002  LENGTH:001  BYTES:0256  RESULT:000
 TRACK:000  HEAD:000  SECTOR:003  LENGTH:001  BYTES:0256  RESULT:000
 TRACK:000  HEAD:000  SECTOR:004  LENGTH:001  BYTES:0256  RESULT:000
 TRACK:000  HEAD:000  SECTOR:005  LENGTH:001  BYTES:0256  RESULT:000
 TRACK:000  HEAD:000  SECTOR:006  LENGTH:001  BYTES:0256  RESULT:000
<PAUSE>

 S/DRIVE:0 96  FM  TRACK:00 SECTOR:09  BYTES:0256  D/DRIVE:1 96  FM
 TRACKS:80   T/ID:000   H/ID:000   S/ID:006   L/ID:001   SECTORS:10
 OPERATION:            RESULT:000 Successful Completion  NORMAL DATA
```

Figure VI: Investigator screen, scan a disc

Initialise status resets all the parameters in the status window. Disc density and the number of sectors per track will be set according to whether the DFS or ADFS is the current filing system.

***command** allows any star command to be sent to the operating system.

It was very disappointing that there was no way of writing directly to the 1770 rather than always emulating an 8271 apart from the osword &7F calls to read and write a track.

This limits what can be done with the 1770. There is still plenty of space available on the 16k eprom to do this, by either an extra star command or setting up a parameter block using all the editing facilities of ADI.

Documentation is a brief 28 page manual. It could have included more information about the FDCs. Although it is possible to get the manufacturers' FDC data sheets these are not easy to read.

There is more information around for the 8271 – see *The Micro User,* January to March 1986 – but there is still too little information about the 1770, although Mike Stallybrass's article in this month's issue should help.

Apart from the limitations mentioned this is an excellent piece of software for experimenting with the disc controllers. ■

PROBLEM

GAMES load successfully on my B OS 1.2 but during play the program fails in some manner – screens become misplaced or broken up, sounds and movements go wrong. It may just stop or break up altogether.

The fault is confined to programs which load below &E00. – J.P. Hamlyn, Dewsbury.

SOLVED

Many games are upset by the presence of the speech chip as they directly manipulate the system VIA. Try removing the chip and see if things improve.

However some intermittent mechanical fault is indicated. Try tapping the board at various points, in that way you can identify the general area.

If that fails I'm afraid it is a job for a professional with test equipment.

STRAIGHT to work this month with a look at Program I. Here we're using the BBC Micro's built-in assembler to load zero page location &70 with zero and then decrement it by one.

Notice that we're using labels rather than numbers, so instead of 0 we use *zero* and we use *zeropage* rather than &70. We assign these labels in lines 20 and 30, before entering the assembler, and position the machine code at &900 in memory, with the line:

```
40 P%=&900
```

Line 50 then uses a left square bracket to signal to Basic that what comes next is assembler code (in Mode 7 this appears as a left-facing arrow). That is, it's to be translated from mnemonics into hexadecimal code to be stored from *P%* onwards. We then leave the assembler with:

```
10 REM PROGRAM I
20 zero = 0
30 zeropage=&70
40 P%=&900
50 [
60 LDA # zero
70 STA zeropage
80 DEC zeropage
90 RTS
100 ]
110 CALL &900
120 PRINT "&70 contains "~?zeropage
```

Program I

```
100 ]
```

Again in Mode 7 this appears as a right facing arrow. Once assembled we run the code with the CALL &900 of line 110. We then print out the value contained in &70.

The program itself shouldn't present too much difficulty if you remember that when we decrease a byte containing zero by one it goes round the clock to 255 – that is, &FF.

As well as labelling values before we enter the assembler, we can also use labels inside the code being assembled to refer to the locations where that part of the code is stored. That is, the labels act as numeric variables taking the value of the memory location they are marking.

For instance, we might want to refer to the first location where code is stored as *start* and the last one as *finish*.

LEARNING
TO
USE
LABELS
TO
GOOD
EFFECT

By MIKE BIBBY

In practice the memory locations we label tend to be the first bytes of instructions, so we put our labels before the mnemonics of the instruction we're labelling.

Program II shows how it's done. To show the assembler that what follows is labelling an instruction we precede the label with a dot. Line 60 labels the first byte of the LDA # zero with *.start* as follows:

```
60 .start LDA # zero
```

Since this is the first byte of the program, which starts at &900, the value of *start* will be &900.

```
10 REM PROGRAM II
20 zero = 0
30 zeropage=&70
40 P%=&900
50 [
60 .start LDA # zero
70 STA zeropage
80 DEC zeropage
90 .finish RTS
100 ]
110 CALL &900
120 PRINT "&70 contains "~?zeropage
```

Program II

Similarly we label the last instruction of the program with *.finish*. See if you can work out the value that *finish* will have before you run the program. To check on these values add:

```
130 PRINT "Start is "~start
140 PRINT "Finish is "~finish
```

The thing to remember is that these labels refer to the addresses of the bytes in memory where your program is stored. They're not the actual contents of the bytes themselves.

As we'll soon see, these labels can be very useful, but before we see how, let's take a closer look at the way the assembler actually works

There's a special word, OPT, that regulates how the assembler works. At our level it isn't the easiest idea to grasp, but you'll soon get used to it.

It's the value following OPT that's important. Depending on this value the program to be assembled will either be listed on the screen or not. This value also decides whether or not any errors in the assembler will be reported.

This can be important, since sometimes you don't want any error messages the first time through an

6502 MACHINE CODE

Part 7

assembly as their causes will be automatically remedied later.

Specifically if OPT is zero or two no listing of the program is produced on assembly. If OPT is two or three errors are printed. These combine to give the following outcomes:

OPT 0.No listing or errors shown.
OPT 1.No errors, but listing shown.
OPT 2.Errors shown but no listing.
OPT 3.Both errors and listing shown.

Program III shows how it works in practice. Here Program I is wrapped up in a loop – lines 40,160 – where the variable *option%* varies from 0 to 3. After each assembly line 150 waits for a keypress, so we can see the effect of each successive OPT.

```
   10 REM PROGRAM III
   20 zero = 0
   30 zeropage=&70
   40 FOR option% = 0 TO 3
   50 PRINT "OPTION "option%
   60 P%=&900
   70 [
   80 OPT option%
   90 .start LDA # zero
  100 STA zeropage
  110 DEC zeropage
  120 .finish RTS
  130 ]
  140 PRINT "Press any key for next o
ption"
  150 wait$=GET$
  160 NEXT option%
```

Program III

Incidentally although our example programs haven't used OPT the BBC Micro automatically defaults to a value of OPT 3 - reporting errors and giving a listing.

Notice that OPT - which is called an assembler pseudo operator - comes in the first instruction after we open the assembly with our left hand square bracket.

When you run Program III you'll see that we do indeed perform the assembly four times, printing out the listing when assembling under OPT1 and OPT3.

As there are no errors in the program OPT 2 and 3 have no effect in this respect. However if you add a mistake, such as:

```
DEC z
```

when the program reaches the stage of assembling it with OPT 2, it will point out the error. There is no such variable as *z*.

In practice we tend to assemble programs with OPT 0 followed by OPT 3. That is, we assemble it with no error reporting or listing, then with both error reporting and listing.

To do this we put the code to be assembled in a FOR...NEXT loop with an initial line of the type:

```
FOR pass% = 0 TO 3 STEP 3
```

When you assemble something twice like this we call it a two pass assembly. Notice that:

```
50 P%=&900
```

is inside the loop. Remember, *P%* is incremented automatically as we assemble the code, so if we're going to assemble it a second time we have to reset our value of *P%* to its initial value.

The reason you tend to assemble the mnemonics in two passes rather than one is that often the assembler needs two goes to work out the addresses the dotted labels refer to.

The program works out the values of the labels on the first pass and then assembles the code, including these values, on the second.

In practice you need two pass assembly to cope with branches – that is, where the program jumps in a manner similar to Basic's GOTO, except that here you jump to a memory location, not a line number.

One cause of such branches is the instruction JMP - short for JuMP (opcode &4C). This just causes the 6502 to continue processing from the instruction whose address is given in the two bytes following the JMP.

```
   10 REM Program IV
   20 beep=&7
   30 oswrch=&FFEE
   40 FOR pass%= 0 TO 3 STEP 3
   50 P%=&900
   60 [
   70 OPT pass%
   80 JMP there
   90 LDA #beep
  100 JSR oswrch
  110 .there RTS
  120 ]
  130 NEXT pass%
  140 CALL &900
```

Program IV

```
0900
0900
0900                OPT pass%
0900    4C 08 09    JMP there
0903    A9 07       LDA #beep
0905    20 EE FF    JSR oswrch
0909    60          .there RTS
```

Figure I: Output of Program IV

So JMP &0940 - which translates as 4C 40 09 - makes the microprocessor continue working from &0940 onwards That is, instead of following along instruction by instruction, the program

```
   10 REM Program V
   20 beep = &7
   30 oswrch=&FFEE
   40 FOR pass%= 0 TO 3 STEP 3
   50 P%=&900
   60 [
   70 OPT pass%
   80 JMP over
   90 .back LDA # beep
  100 JSR oswrch
  110 RTS
  120 .over JMP back
  130 ]
  140 NEXT pass%
  150 CALL &900
```

Program V

→

From Page 55

branches to somewhere else in memory to pick up its next instruction.

Program IV uses a JMP combined with a label to branch over two lines of code that would otherwise cause a beep:

```
LDA #beep
JSR oswrch
```

Before we encounter these lines, though, we meet:

```
JMP there
```

This causes the microprocessor to immediately perform the instruction at the address labelled *there*, which in this case is a simple RTS. The assembler output is shown in Figure I. As you can see the RTS which is labelled *there* is placed at &0908 in memory, so:

```
JMP there
```

translates as:

```
4C 08 09
```

To prove that you really do need a two pass assembly to handle branches like this try leaving out lines 50,70 and 130 – that is, the OPT and the loop – and see what error message you get. As you'll see the micro won't recognise the label before the second pass.

In the case of Program IV we branch forward. That is, the label in the JMP refers to somewhere further on in the program. We can just as easily branch backward, as the rather contrived example in Program V shows.

```
0900
0900
0900            OPT pass%
0900  4C 09 09  JMP over
0903  A9 07     .back LDA # beep
0905  20 EE FF  JSR oswrch
0908  60        RTS
0909  4C 03 09  .over JMP back
```

Figure II: Output of Program V

Here we again JMP over code that would cause a beep, this time to the label *over*. That is, we branch forward. However once we get to *over*, we find yet another JMP, this time to *back*, which is our beeping code followed by an RTS to take us back to Basic.

As you can see the second branch from *over* to *back* goes backwards in memory, hence it's referred to as a backward branch. Figure II shows the code generated. Try following it through step by step.

So we've seen how labels can be used to identify sections of our machine code, and how we use two pass assembly to cope with them. We've also looked at one type of branching, where we are forced to JMP to an address.

For practice, try writing your own code that jumps to labels, using two pass assembly.

● *Next month we'll look at another more powerful way of branching.*

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HIGH QUALITY DISC DRIVES BY OPUS
with free 2 year warranty
Cased with leads, manual and utility disc, and even a power plug – ready to go.

5.25"	Ex VAT	Inc VAT & Carriage
Acorn 1770 DFS	40.83	46.95
Opus DDOS	40.83	46.95
SPECIAL OFFERS		
SX100 with DDOS	95.61	109.95
SX400S with DDOS	130.39	149.95
BBC SX (Uses BBC's Power Supply)		
SX100 40 track single side (100K)	69.52	79.95
SX400S 80 track double side (400K) 40/80	95.61	109.95
Dual Ex PSU		
DX200 Dual 40 track single side	130.39	149.95
DX800S Dual 80 track double side 40/80	173.87	199.95
With Built In Power Supply		
S100 40 track single side (100K)	82.57	94.95
S400S 80 track double side (400K) 40/80	113.00	129.95
Dual Drives (with Power Supply)		
D200 2 x 40 track single side (200K)	173.87	199.95
D400S 2 x 80 track single side (400K) 40/80	199.96	229.95
D800S 2 x 80 track double side (800K) 40/80	199.96	229.95

NOTE – All 80 track drives have a 40/80 switch!

Challenger 256k (upgradeable to 512K RAM) with 80 track double sided drive and disc interface	165.17	189.95
Challenger 256K to 512K Upgrade	31.26	35.95
Challenger 512K	195.61	219.95

3" DRIVES FOR THE AMSTRAD		
DD-1 Drive + Interface	133.00	152.95
FD-1 (No Interface)	86.04	98.95
MICROVITEC RGB MONITORS (BBC)		
1431 (472 x 585 dots)	182.57	209.95
1431 APMS4 (with audio & PAL)	199.96	229.95
1451 (653 x 582 dots)	234.74	269.95
1451 APMS4	299.09	343.95

Dept. MU8 86, 46 Middle Street,
Blackhall, Hartlepool Cleveland
TS27 4EA. Tel: 0783 872430

Sorry, office only – No callers without appointment

BBC ROM UTILITY SOFTWARE		
Wordwise (Word-processor)	31.26	35.95
Wordwise Plus (Word-processor)	40.65	46.75
View 2.1 (Word-processor)	41.26	47.45
View III (Word Processor)	61.00	70.15
COMPUTERS		
BBC B+ 64K	382.67	439.95
Master 128	426.04	489.95
EPSON COMPUTERS – IBM COMPATIBLE		
Taxi PC 360K Drive	649.95	747.44
Taxi PC 2 x 360K Drive	749.95	862.44
Taxi PC 360K + 20 M6	1249.95	1437.44
Mouse/Colour Video Card/Taxi	259.95	298.95
20Mb Hard Drive for IBM compatibles c/w Card, Cable and instructions	434.74	499.95
AMSTRAD COMPUTERS		
PCW8512	469.52	539.95
PCW8256	356.49	409.95
CPC 6128 (Green)	247.78	284.95
CPC 6128 (Colour)	321.70	369.95
OTHER BBC PERIPHERALS		
QFS 2.0 RBC Disc Interface	60.82	69.95
Penman plotter/turtle/mouse	217.35	249.95
Teletext Receiver	188.95	217.29
6502 Second Processor	177.50	204.13
Z80A Second Processor	312.95	359.89
ATPL ROM Board	39.09	44.95

MEDIA – ARCHIVE DATA – EX DYSAN FACTORY! (Fully guaranteed)
High quality diskettes 5.25" boxed in 10's with FREE plastic library case

40 Track SSSD	9.13	10.50
40 Track DSDD	9.52	10.95
80 Track SSSD	12.83	14.75
80 Track DSDD	11.74	13.50
3" Disc (10)	37.35	42.95
3" Disc (each)	3.91	4.50
HEAD CLEANING KITS		
3M Standard	13.87	15.95
Rexel Drive/KBD/VDU Cleaning Kit	19.96	22.95

EXPLORE THE EXCITING WORLD OF COMPUTER GRAPHICS WITH THE UNIQUE LOW COST

GRAFPAD 2

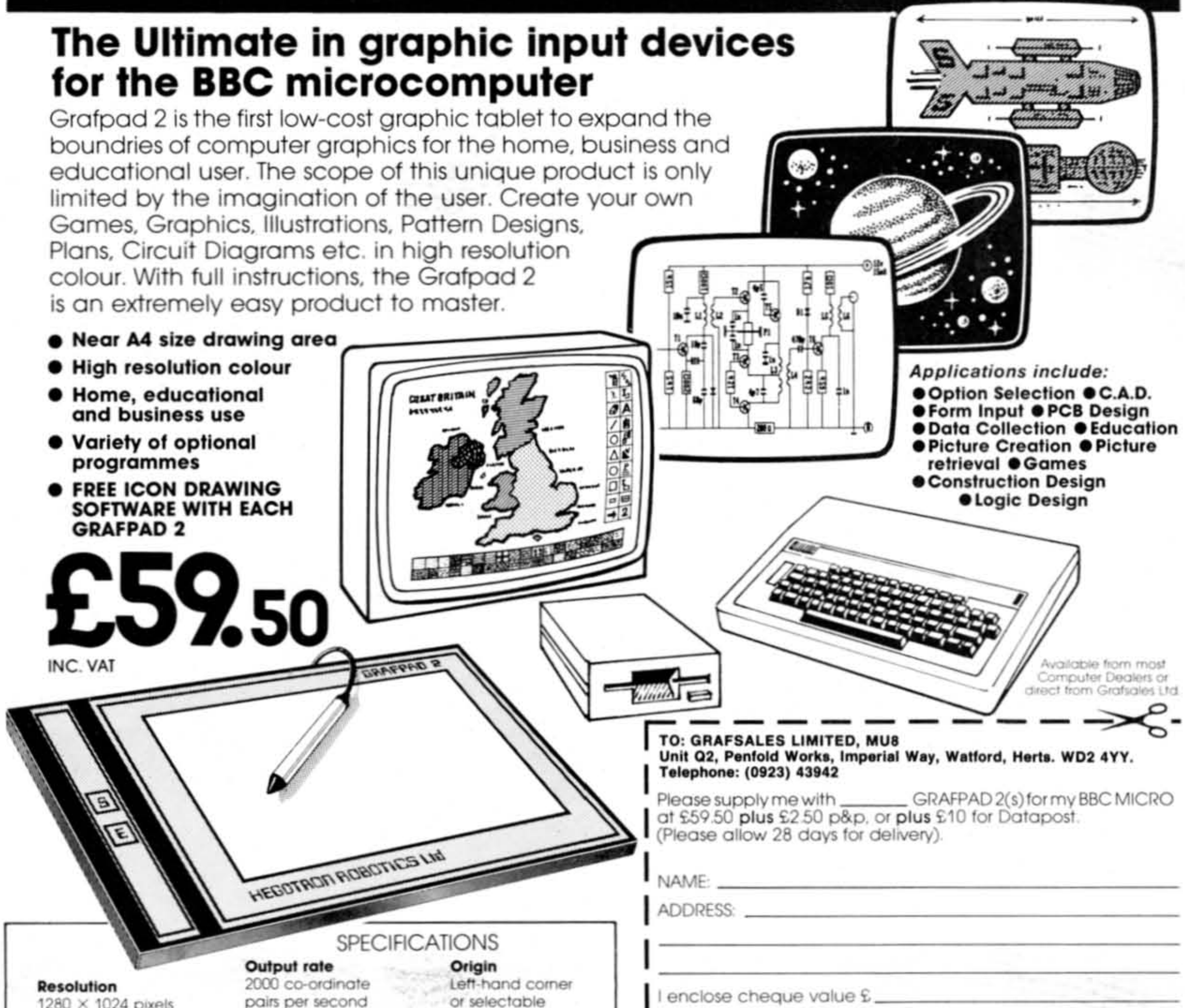
The Ultimate in graphic input devices for the BBC microcomputer

Grafpad 2 is the first low-cost graphic tablet to expand the boundries of computer graphics for the home, business and educational user. The scope of this unique product is only limited by the imagination of the user. Create your own Games, Graphics, Illustrations, Pattern Designs, Plans, Circuit Diagrams etc. in high resolution colour. With full instructions, the Grafpad 2 is an extremely easy product to master.

- **Near A4 size drawing area**
- **High resolution colour**
- **Home, educational and business use**
- **Variety of optional programmes**
- **FREE ICON DRAWING SOFTWARE WITH EACH GRAFPAD 2**

£59.50

INC. VAT



Applications include:

● Option Selection ● C.A.D.
● Form Input ● PCB Design
● Data Collection ● Education
● Picture Creation ● Picture retrieval ● Games
● Construction Design
● Logic Design

Available from most Computer Dealers or direct from Grafsales Ltd.

TO: GRAFSALES LIMITED, MU8
Unit Q2, Penfold Works, Imperial Way, Watford, Herts. WD2 4YY.
Telephone: (0923) 43942

Please supply me with _______ GRAFPAD 2(s) for my BBC MICRO at £59.50 **plus** £2.50 p&p, or **plus** £10 for Datapost. (Please allow 28 days for delivery).

NAME: ____________________

ADDRESS: ____________________

____

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I enclose cheque value £ ____________________

If you prefer to pay by Access or Barclaycard, please state which...

BARCLAYCARD/ACCESS Card No. ____________________

SPECIFICATIONS

	Output rate 2000 co-ordinate pairs per second	**Origin** Left-hand corner or selectable
Resolution 1280 × 1024 pixels		
Repeatability 1 pixel	**Interface** Parallel	**Dimensions** 350 × 260 × 12mm

TECHNOMATIC

17 Burnley Road, London NW10 1ED Tel: 01-208 1177
305 Edgware Road, London W2 Tel: 01-723 0233

LEADING SUPPLIER TO THE BBC MARKET
ESTABLISHED OVER 15 YEARS

BBC MASTER SERIES

AMB15	BBC MASTER Foundation computer 128K	£395 (a)
AMB12	BBC MASTER ET 128K (only ANFS)	£319 (a)
AMC06	Turbo (65C102) Expansion Module	£102 (b)
512 Upgrade (Expected to be in stock by July)		£347 (a)

ADF13 Rom Cartridge	£13 (d)
ADF10 Econet Module	£43 (c)
ADJ22 Ref. Manual Part I	£14.95 (c)
ADJ23 Ref. Manual Part II	£14.95 (c)
ADJ24 Advanced Ref. Manual	£19.50 (c)
View 3.0 User Guide	£10 (d)
Viewsheet User Guide	£10 (d)

UPGRADE KITS

1.2 OS ROM	£7.50 (d)
DNFS ROM	£17.50 (d)
Econet Kit	£55 (d)
1770 DFS Upgrade for Model B	£43.50 (d)
ADFS ROM (for B with 1770 DFS & B plus)	£26 (d)
64K Upgrade Kit for B plus	£35 (d)

ECONET ACCESSORIES

Econet Starter Kit	£85 (b)
Econet Socket Set	£34 (c)
File Server Level I	£75 (d)
File Server Level II	£210 (d)
Econet Bridge	£174 (b)
Printer Server Rom	£41 (d)
10 Station Lead set	£26 (c)
Adv. Econet User Guide	£10 (d)

ACORN 32016 CO-PROCESSOR

Acorn Cambridge Co-processor combines with the BBC micro to provide full 32 bit processing. The National Semiconductor 32016 processor performs all language and application processing, the NS32081 floating point processor maximises the performance and provides support for IEEE standard fp handling.

The specially developed operating system PANOS, provides efficient interfacing between the languages and the hardware and software of the BBC micro incl. the variety of ACORN filing systems: DFS, ADFS and NFS. PANOS provides a variety of utilities including a full screen editor and a linker providing acces to both library routines and cross language linking.

FORTRAN 77, PASCAL and C languages with mainframe type implementations, fully compiled and provided with appropriate library support are included. Other languages include, Cambridge LISP with its compiler, a 32016 assembler and a 32bit interpreted implementation of BBC BASIC with full screen editor. 1 Mbyte of RAM is included as standard.

32016 CO PROCESSOR (Currently available from stock) £1130 (a)

Please phone or write for full specifications on the Cambridge Co-processor and Cambridge Workstation.

WINCHESTER DRIVES

Acorn Hard Discs are now available in 10 and 30 Mbyte versions. The drive plugs into the 1 MHz bus. The ADFS filing system with its hierarchical filing structure provides excellent file management facilities. Data transfer rate of 1Mbit/sec and average seek time of 85 ms provides the user very fast access to very large amounts of data. File Server Level III is installed as standard on Acorn Winchesters. The Technomatic Winchester Drive is supplied with the Acorn ADFS Rom and offers good value for money.

Acorn 10 Mbyte Winchester	£1100 (a)
Acorn 30 Mbyte Winchester Drive	£1630 (a)
Technomatic P20HD 20 Mbyte Hard Disc	£659 (a)

TECHNOLINE

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FOR DETAILED SPECS
ON THE MASTER
SERIES & UPGRADES

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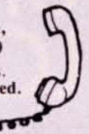
or 01-452 1500
(weekdays 7pm9pm,
24 hours weekends)



Technical Information:
1200/75 Baud, Standard Viewdata/Prestel Protocols.
Please note that a 'Prestel' type terminal must be used.

Please phone for our latest Educational Price List.

EPROMs/RAMS

2764-25	£2.00 (d)
27128-25	£2.50 (d)
6264LP-15	£3.40 (d)

ACORN 2nd PROCESSORS

Acorn Z80 2nd Processor: Z80 CPU with 64K of RAM housed in a separate case with a integral power supply interfaces with the BBC computer through the TUBE. It converts the BBC into a CP/M system and its comprehensive package of software provides a suitable basis to set up a business system. £329 (a)

Acorn 6502 2nd Processor: This processor provides faster data processing speeds and larger memory. Particularly useful for use with Hi View word processor for production of large documents. £162 (b)

MULTIFORM Z80 2nd PROCESSOR

This processor converts your BBC into a powerful CP/M system making it capable of operating in almost any CP/M format. Full details on page 4. £299 (b)

TORCH Z80 2nd PROCESSOR

ZEP100: This Z80 processor with 64K fits internally in the BBC computer and has the operating system in a ROM. It is supplied with the PERFECT suite of software comprising of a database, wordprocessor and a spreadsheet and a BBC BASIC for Z80. £229 (a)

TZDP240: ZEP100 with TECHNOMATIC PD800P dual drive with built in monitor stand. £469 (a)

ACORN TELETEXT ADAPTOR

This adaptor will convert the BBC computer into a teletext receiver capable of decoding and displaying the CEEFAX and ORACLE pages and the monitor screen. These pages can also be saved for later reference. BBC TV transmit educational software on their CEEFAX system which can be downloaded free of charge. £125 (b)

ACORN IEEE INTERFACE

This interface enables a BBC computer to control any scientific and technical equipment that conforms to the IEEE488 standard, at a lower price than other systems, but without sacrificing any aspect of the standard. The interface can link up to 14 IEEE compatible devices. Typical applications are in experimental work in academic and industrial laboratories, with the advantage of speed, accuracy and repeatability. The interface is mains powered and comes with cables, IEEEFS ROM, and user guide. £278 (a)

ROBOCOM BITSTICK

The renowned 'BITSTICK' graphic ÇAD package. Using the on-screen menu and colour pallette, it can draw freehand as well as lines and shapes with great accuracy. Any part of a drawing may be magnified many times, and up to 192 drawings may be saved on a disc. In total, a friendly yet sophisticated CAD system offering tremendous value.

ROBOCOM BITSTICK I £299 (a)

ROBOCOM BITSTICK II: This package is as Bitstick I with software upgraded to allow scaling and auto dimensioning. Multiplotter driver is also supplied with the package. £775 (d)

Upgrade for Bitstick I to II	£415 (b)
Bitstick Multiplotter Driver (most popular plotters included)	£69 (b)
Epson FX80 Screen dump routine for Bitstick I	£35 (d)
Epson FX80 dump for Bitstick II	£39 (d)

DISC DRIVES

All drives listed below are fully compatible with single and double density DFSs.
The larger capacity referred to below is for the Acorn's ADFS system.

Your computer installation can look like this with our PD800P drive

This highly successful drive offers unique features:

New slimline Mitsubishi mechanisms with ultra low power consumption (only 8 watts per mechanism), front locking lever and capable of single or double density operation. Ultra fast track access times and head settling times.

Fully compatible with the DFS and ADFS filing systems on the new MASTER's range.

40/80 switchable with switches located on the front panel. A generously rated switch-mode power supply ensures reliability with minimum heat dissipation for long periods of operation.

The mechanisms are set inside a sturdy monitor stand painted in 'BBC-matching' beige. Its 'looks' are enhanced by its black front panel, with attractive enamel-white markings.

These disc drives with a built-in monitor plinth provide a compact installation and give a professional look to the system.

As with all standard TECHNOMATIC drives it comes complete with a data cable, and a mains lead with a suitably fused 13A moulded plug.

PD800P **2×400K/2×640K 40/80T DS** £249 (a)

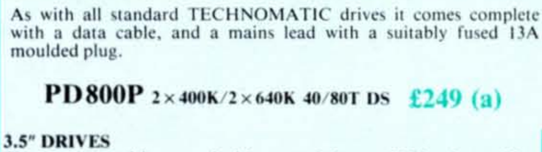
3.5" DRIVES

These compact drives, used with most of the new 16 bit micros offer fast access times and high performance with minimum of power consumption. The mechanisms are 80 track double sided and are capable of both single and double density operation. The single drive is offered in a dual case with a blanking plate for future upgrading. The drives are supplied with all the necessary cables to make them ready for connection to a computer.

1 × 400K/1 × 640K 80T DS:	**TS35 1**	£109 (b)	**PS35 1** with psu	£124 (b)
2 × 400K/1 × 640K 80T DS:	**TD35 2**	£199 (b);	**PD35 2** with psu	£219 (b)

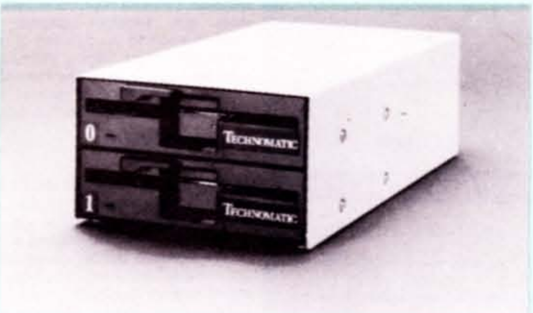
DISC DRIVE MULTIPLEXER

The cost-effective alternative to networking! A self-contained unit that enables up to four computers to be connected to one single or dual disc drive. No hardware modifications — simply plugs into the computers disc interface connectors. No ROMs or other software needed. All DFS commands work as normal. The switching of drives between computers is totally automatic and completely invisible to the user. This unit is ideal for installing in classrooms and other situations, where networking is not planned or necessary, or where costs must be kept low. In many cases software needs to be shared, although full networking complexity and cost is not needed. Several of these units can be connected in series to allow more computers to access the same discs, i.e. two quads connected together will allow 7 computers to share 1 drive. Units are supplied with 5' of cable per outlet as standard. Mains powered.



TDM4 Quad Unit (up to 4 computers)	£135 (a)
TDM2 Dual Unit (2 computers)	£75 (b)

PD800



TECHNOMATIC's stacked drives are housed in smart metal casings painted in BBC beige colour and are built to the same exacting standards as PD800P drives. The drives are fitted with integral switch mode power supply and supplied with a mains lead with a suitably fused 13A moulded plug and a data lead.

These drives are fitted with the new model MITSUBISHI mechanisms, which have been specially adapted for us to fit the 40/80 track switches on the front panel of the mechanisms. This would mean that the user no longer needs to grope at the rear of the drive to set the correct track setting.

PD800 **(2 × 400K/2 × 640K 40/80T DS)** £229 (a)
TD800 **(as PD800 but without the psu)** £209 (a)

SINGLE DRIVES

1 × 400K/1 × 640K 40/80T DS

TS400 £109 (b) **PS400** **with psu** £129 (b)

NEW

Technomatic's hard disc drive with a 400K/640K floppy drive with integral power supply and built-in monitor stand. Provision has been made for the future installation of a tape streamer.

P204HP includes ADFS rom £865 (a)

3M 5¼" FLOPPY DISCS

40 T SS DD	£11.00 (d)
40 T DS DD	£14.00 (d)
80 T SS DD	£16.50 (d)
80 T DS DD	£18.50 (d)

(£1 extra for library case packing)

FREE
SWISS ARMY
KNIFE
for every three
packs of
discs.

3M 3½" FLOPPY DISCS

80 T SS DD £18 (d) 40 T DS DD £25 (d)

Discs in packs of ten

SPECIAL BULK DEAL

High quality 5.25" with our usual lifetime warranty. The discs are packaged in a lockable plastic box.

50 Single Sided 40 track Double Density	£42.50 (b)
50 Double Sided 40 track Double Density	£55.00 (b)
50 Double Sided 80 track Double Density	£65.00 (b)

DISC STORAGE BOXES

NON LOCKABLE	**DB530** 30 × 5¼"	£6.00 (c)
LOCKABLE	**DB340** 40 × 3½"	£8.50 (c)
DB550 50 × 5¼" **£9.50**	**DB570** 70 × 5¼"	£11.00 (c)
	DB5100 100 × 5¼"	£13.00 (b)

DRIVEHEAD CLEANING KIT

The **FLOPPICLENE** drive head cleaning kit is an ideal way to ensure the optimum performance of your drives. The use of disposable cleaning discs eliminates the risk of contamination and abrasion of sensitive driveheads. These risks are normally inherent in the reusable drivehead cleaning kits. 5¼" £14.50 (d)
Floppiclene with 20 disposable cleaning kits. 3½" £16.00 (d)

TECHNOMATIC

01-208 1177

BBC Computer & Econet Referral Centre

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17 Burnley Road
London NW10 1ED

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15 Burnley Road
London NW10 1ED
Tel: 01-208 1177
Telex: 922800
(close to Dollis Hill ⊖)

West End Branch
305 Edgware Road
London W2
Tel: 01-723 0233
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For fast delivery telephone your order on 01-208 1177 using VISA/Access Card

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Please add carriage
(a) £8 (Datapost)
(b) £2.50
(c) £1.50
(d) £1.00

EPSON PRINTERS

LX80 £195 (a) **Tractor Feed** £20 (c)

FX85 £315 (a) **FX 105** £449 (a)

A limited no of FX80s available at £260 each.

LQ Range: This range with 24 pin dot matrix printers offers a high, 200 cps, draft speed and superb correspondence quality print at 67 cps and truly high resolution graphics and a variety of fonts.

LQ800 £479 (a) **LQ1000** £729 (a)

TAXAN PRINTERS

KP810 (80 col)	£230 (a)
KP910 (156 col)	£379 (a)

JUKI 5510 PRINTER

A new dot matrix printer from the reliable JUKI stable. Features include a fast 180 cps. NLQ at 40 cps. Full EPSON/IBM compatibility. 3K buffer as standard expandable to 15K. Full graphics capability and a variety of fonts including international characters set. £229 (a)

COLOUR PRINTERS

EPSON JX80 4 colour.	£420 (a)
Integrex Colour Jet Printer.	£549 (a)
Canon PJ1080A	£369 (a)

BROTHER PRINTERS

NEW

A new range of dot matrix printers.

BROTHER M1409	£299 (a)
BROTHER M1509	£399 (a)

DAISY WHEEL PRINTERS

BROTHER HR15: * 14 cps * 3 K Buffer * Two colour printing * Proportional spacing * Underline * Bold * Shadow print * Super/Sub script + many other features.

BROTHER HR15 **£315 (a)**

JUKI 6100: * 15 cps * 2K Buffer * Switchable 10/12/15 cpi * Proportional printing * Linear Motor for maximum reliability.

JUKI 6100 £249 (a)

DOTPRINT PLUS

The most versatile NLQ rom for the BBC Micro. DOT PRINT PLUS not only gives you the 10 character pitch at 6 lines/in with underlined and double width characters as required but unlike all other NLQ roms, it offers a lot more.

- a built in CHARACTER FONT EDITOR enables disc users to create their own type faces for using in printing spooled text files.
- a built in View Printer Driver.
- MICROSPACING for professional justification in VIEW and — with discs — in WORDWISE/PLUS.
- true BOLD PRINT in addition to double width.
- 12 char pitch as standard — providing 96 CHARACTERS PER LINE on the FX/RX 80 for example.
- simple control codes allow VARIABLE PITCH LINE SPACING in 1/72" increments and VARIABLE PITCH from 12 cpi in increments of 1/240". (10 cpi can be selected by a single control code).

Suitable for use with printers fully compatible with EPSON quad density graphics.

DOTPRINT PLUS for FX/RX and compatibles.	£28 (d)
DOTPRINT Dual for MX Range.	£28 (d)

PRINTER BUFFER & SHARERS

BUFFALO 32K Buffer for EPSON PRINTERS: This compact 32K buffer can be fitted internally on most EPSON printers within a few minutes. It does not require external power or any modification to the printer. It will hold about 15 A4 pages of text freeing your computer for other jobs in a fraction of the time it would normally have to wait for the printer to finish all that printing. Supplied with full fitting instructions.

Buffalo 32K Buffer £75 (d)

PRINTER SHARER/BUFFER: A unique sharer/buffer that provides a simple solution to improve system utilisation. It can be connected to up to three computers and it will automatically switch between the computers to scan for data — no manual switching required. High speed data input rate to the buffer cuts down the normal waiting time for the computers for the printing operation to complete and thus allowing the computers to be used for other uses. The 64K buffer would hold over 30 A4 pages of text.

Facilities include: COPY, PAUSE AND RESET. LED indication for percentage of memory available and data source. Mains powered. Send for detailed specification.

Available in 64K and 256K versions

TSB 64 £199 (b) **TSB 256** £275 (b)

A Serial Buffer/Sharer will soon be available. Please send for details.

PERIPHERAL & COMPUTER SHARERS

An extended range of peripheral sharers to allow the user to switch between computers, printers and modems. High quality switching mechanisms housed in fully shielded metal cases ensure reliability. No external power input required.

All lines on the sharers are fully switched (36 on parallel and 25 on serial)

	Parallel	**Serial**
3 Computers to a Printer	36V36-3 £69(c)	25V25-3 £64(c)
4 Computers to a Printer	36V36-4 £85(c)	25V25-4 £74(c)
2 Computers/2 Printers x-over	36V36-X £69(c)	25V25-X £69(c)
BBC Cable Set 3 to 1 (1m ea).	£32(c)	£34(c)
BBC Cable Set 4 to 1 (1m ea).	£39(c)	£41(c)

BBC Computer Sharer: TCS26:
1 computer to 2 printers
fitted with Cable. £19.50 (c)

EPSON HI-80 PLOTTER

EPSON technology has once again scored a first by introducing a sophisticated A4 size plotter that does not need specialised software or programming skills to operate it and yet keep the cost within the reaches of all computer users. Features include 4 pens at a time — upto 10 colours to choose from, a variety of pen nibs, high speed plotting. Powerful software command codes include single commands to plot circles, eclipses or triangles. Line or bar graphs and pie charts can be plotted in a variety of exciting styles very simply by keying in the data into the computer.

Detailed leaflet on request.

Epson HI-80 Plotter £325 (a)

HITACHI 672 PLOTTER

A high speed, compact A3 plotter with 4 colours and high accuracy. Both serial and parallel ports as std. Plots on either OHP film or plain paper. Operates on HP GL or single character commands and is easy to interface to most graphics software. £465 (a)

GRAPHICS PLOTTER

Available again with considerable enhancements to the original model. Plotting area has been increased to A3 size with a resolution of 0.1mm. Opto sensor converts the plotter into an input device to scan and digitise pictures, traverse mazes and investigate methods of artificial intelligence. A more powerful drill/router attachment and scriber provide facilities for drilling on various materials and fine line drawing on coated materials.

Total cost: £629 (a)

Basic plotter and accessories available separately. Send for details.

PLOTMATE

From Linear Graphics a range of fast, accurate and easy to use plotters.

The A4 Plotmate is the ideal drawing companion for all BBC micros, the Master and Cambridge Work Station. Plugs into the user port or printer port of your BBC Micro and directly driven by the BBC graphics commands in BBC Basic, Logo or indeed any high level language without additional driver software.

Plots onto paper, card or acetate film in up to 6 colours using fibre, OHT or ballpoint pens.

A4 Plotmate £299 (a)

A4M and the new A3M models plug into BBC and all leading micros. They run on a wide range of Linear Graphics and third party software. Numerous functions and add-on capabilities ideally suited to the requirements of the Education, Industry and Business environments including mathematical modelling, data display, CAD, mapping, optical scanning and PCB design.

A4M £399 (a) **A3M** £549 (a)

PRINTER ACCESSORIES

EPSON ACCESSORIES:

Interfaces:

8143 RS232	£28 (d)
8148 + RS232 + 8K	£75 (d)
8165 IEEE + Cable	£65 (d)
8148 RS232 + 2K	£57 (d)
8132 Apple II	£60 (d)
8177P NLQ for FX80 + /FX100 +	£99 (d)

Parallel & Serial Buffers of various size also available.

FX80/80 + /85 Tractor Attachment	£37 (c)
FX80/80 + Paper Roll Holder	£17 (c)
LX80 Tractor Feed	£20 (c)
LQ800 Tractor Feed	£44 (b)

SHEET FEEDERS:

8338 LX80	£49 (b)
8333 FX100 + /105	£169 (a)
8331 FX80 + /85	£129 (b)
8330 RX80 +	£129 (b)
LQ800	£129 (b)

Ribbons:

RX/FX100/100 + . FX105	£10 (d)
RX/FX80/80 + , FX85	£5 (d)
LX80	£4.50 (d)
H180 Pen Set (Aqueous/Ball point)	£7.50 (d)

Dust Covers:

FX80	£5.50 (d)
TAXAN/Canon KP810	£6 (d)
FX100	£7.50 (d)
KP910	£7 (d)

TAXAN CANON Accessories:

RS232 + 2K buffer	£78 (d)
Ribbon	£6 (d)

JUKI 6100

RS232 Interfaces	£65 (d)
Tractor Feed	£129 (a)
Ribbon (Carbon)	£2.00 (d)
Spare Daisy Wheel	£14 (d)
Sheet Feeder	£182 (a)

BROTHER HR15

Daisy Wheel	£18 (d)
Tractor Feed	£90 (a)
Ribbon (Carbon/Nylon)	£3.00 (d)
Sheet Feeder	£182 (d)
Keyboard	£135 (a)

Printer Leads:

BBC Parallel Lead (1.2m)	£6 (d)
BBC Serial Lead (1.2m)	£6 (d)

Other lengths can be supplied on order:

IBM Parallel Lead (2m)	£12 (d)

PAPER & LABELS

Plain Fanfold paper with micro perforations:

2000 sheets 9½" × 11"	£13 (b)
2000 sheets 14½" × 11"	£18.50 (£4.50)

Labels/1000:

Single Row 3½ × 1 7/16"	£5.25 (d)
Triple Row 27/16" × 17/16"	£5 (d)

MULTIFORM Z80

The MULTIFORM Z80 2nd Processor for the BBC Micro — opens the horizons of CP/M software to the BBC micro user

- Will enable running of almost any CP/M applications software
- Will enable transfer of data between different disc formats
- Emulates the two terminals most frequently used by CP/M software

MULTIFORM Z80 interfaces directly to a normal BBC micro requiring no hardware changes. It is supplied with OS/M operating system in rom which can run all software that obeys CP/M 2.2 constraints and its configuration is not hardware specific.

MULTIFORM Z80 is truly flexible and can be used with any BBC micro drive system, single or dual drive, 40 or 80 track format and single or double sided. Unlike other currently available Z80 processors for the BBC micro, there are absolutely no restrictions on the type of drive that can be used with the MULTIFORM Z80.

MULTIFORM Z80 plugs into the 1MHz bus connector of the BBC micro. It is mains powered and does not put any extra load on the BBC's psu. The data cable can be several feet in length, allowing convenient siting of the MULTIFORM Z80, unlike present second processors, which have 8″ cables.

Twenty eight CP/M formats are supplied which include: Acorn Z80, RML 380Z and 480Z, Torch (read only), Osborne, Televideo . . . we also offer to configure other formats at an extra charge."

Rom based OS/M operating system is fully compatible with Acorn's single and double density disc interfaces. Installing the OS in rom allows more space on discs for programs and data and response to system commands is very fast. (Note: Single density DFS will only read/write to single density CP/M formats).

MULTIFORM Z80 can format, read or write from a very wide range of CP/M disc formats. On a dual drive system, the drives can be set up independently to run two different formats at the same time. This will enable:

- The user to buy software from a very wide range of suppliers without having to worry about the type of format supplied.
- Interchange of valuable data and files among users of various CP/M computers.
- Using a system at home for preparing data required in the office.
- Software writers/developers to write software in any one format and transfer it to any other format without having to pay for expensive porting charges.

MULTIFORM Z80 is supplied with a library of a number of popular CP/M formats and a utility disc containing a program for creating files for the additional formats. Each library can load 32 formats and there are no restrictions on the number of librarires that can be created.

The utility disc also contains a program to interconvert ASCII texts wordprocessed on a normal BBC and under OS/M or CP/M.

MULTIFORM Z80's terminal emulation includes the ADM-3A, the HAZELTINE 1500 and the BBC VDU making the installation of most of the well known CP/M software easy.

MULTIFORM Z80 converts your BBC computer into an almost universal CP/M machine and adds the power of being able to run two different formats simultaneously, which currently is possile on only the very sophisticated specialist machines.

For any one working or intending to work in a CP/M environment, MULTIFORM Z80 is an indispensable tool.

In offices where there are a multitude of CP/M machines and a few BBCs, MULTIFORM Z80 will prove to be invaluable for transferring data between the various CP/M machines.

MULTIFORM Z80 (including utility disc, library disc and manual) **£299 + £4 p&p**

(When ordering please specify the type of DFS, MULTIFORM Z80 will be used with)

SPECIAL MULTIFORM UTILITY to read and write to IBM PC Disc. **£49 (d)**

CP/M SOFTWARE FOR TORCH & ACORN Z80 PROCESSORS

We can now supply almost any CP/M based software package in a format suitable for the Torch Z80 and Acorn Z80 second processors. Phone for details on prices for popular packages for IBM

Please phone for our new professional software catalogue

WORDSTAR PROFESSIONAL The advanced word processing package comprising of WordStar, MailMerge, StarIndex and SpellStar, a total combination offering substantial savings on individual prices. WordStar is the best selling word processing program on the market. Extensive operator aids include a comprehensive friendly manual, step-by-step training guide, command cards, on-screen menus. Spellstar checks text files against its 20,000 word-plus dictionary. You can both add to the dictionary and create specific supplementary ones. Mailmerge is ideal for mailing applications. It enables the fast production of personalised form letters, mailing labels, invoices, etc. StarIndex creates alphabetical indexes, tables of contents, paragraph numbering etc.

WORDSTAR PROFESSIONAL £310 (a)
WORDSTAR £275 (a) WORDSTAR Upgrade to W/S Prof £195 (a)

DBASE-II Undoubtedly 'The Database', can be used for an almost limitless number of business applications, ranging from mailing list preparation through to running accounting ledgers and payrolls. An on-disc tutorial takes you from setting up a simple file all the way through to setting up custom screens and reports. Automatic calculations may be performed on data. Fields or entire databases may be modified or replaced with single, English-like basic commands; Dbase-II can therefore be used by general personnel having no programming knowledge. It can be tailored to suit a variety of professions and individual needs, with files such as accounting, payroll, time billing, job costing, scheduling and mailing lists. It can access several files at a time. It is fast, flexible and powerful. **£310 (a)**

SAGE ACCOUNTS: This package has been designed for the smaller business, for the user who is unfamiliar with computers but wanting or needing to computerise the bookkeeping and accounting functions. Sage is easy-to-learn and easy-to-use and is complete with a full tutorial booklet and a free manufacturers 90-day 'Hot-Line' support. It is a truly integrated package (all on one disc!) and covers Sales, Purchase & Nominal Ledgers, with a capability of handling up to 999 accounts per ledger. It will handle all your Sales and Purchase invoices and can easily generate account & management reports. £375 **Sage plus** (£695) for the larger business, and **Sage Payroll** (£195)

Other packages available include PRO-PASCAL, CIS-COBOL, Supercalc II, MACRO-80 etc. Please telephone with your requirements.

MicroPros
Pocket Series for Acorn and Torch Z80
Processors to be available early July.
Please phone for details.

IBM SOFTWARE: We are able to supply most popular software packages including: WORDSTAR, WORD, EASY-WRITER, DBase-II & III, LOTUS-1-2-3, VISICALC, SAGE etc. Please telephone with your requirements.

PROFESSIONAL SOFTWARE PUBLICATIONS

Wordstar made easy	£16.95 (c)
Introduction to Wordstar	£17.95 (c)
Wordstar Handbook	£11.95 (c)
dBase-II for the first time user	£16.95 (c)
Understanding dBase-II	£22.95 (c)
Understanding dBase-III	£22.95 (c)
Multiplan Made Easy	£18.95 (c)
Multimate Complete Guide	£16.95 (c)
ABC of LOTUS 123	£15.95 (c)
The RS232 Solution	£17.95 (c)
CP/M Bible	£15.95 (c)
Soul of CP/M	£14.95 (c)
CP/M Handbook	£14.95 (c)
Mastering the CP/M	£17.95 (c)
Computer Spreadsheets	£7 (d)

(no VAT on books)

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Telex: 922800
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West End Branch
305 Edgware Road
London W2
Tel: 01-723 0233
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(a) £8 (Datapost)
(b) £2.50
(c) £1.50
(d) £1.00

MONITORS

(All Monitors supplied with BBC Lead)

RGB MONITORS

1431 14″ RGB Std Res	452 × 585 pixels	£179 (a)
1451 14″ RGB Med Res	653 × 585 pixels	£229 (a)
1441 14″ RGB Hi Res	895 × 585 pixels	£375 (a)

MICROVITEC 14″ RGB/PAL/Audio

1431AP 14″ Std Res	452 × 585 pixels	£199 (a)
1451AP 14″ Std Res	653 × 585 pixels	£275 (a)

The above monitors are available in plastic or metal case.

MICROVITEC 20″ RGB/PAL/Audio

2030CS 20″ Std Res £380 (a) **2040CS** 20″ Hi Res £685 (a)

TAXAN 12″ RGB

K12SV3: A high performance high res monitor with desk matt screen with options to switch to monochrome green/amber. IBM Compatible £324 (a)

MITSUBISHI XC1404 14″ Med Res RGB:

BBC/IBM Compatible. A new monitor with etched dark screen with both brilliance and contrast controls giving sharp graphics and text display. £219 (a)

EPROMER II

A sophisticated eprom programmer that handles the full range of popular single rail eproms (incl 27256) and allows the user full control of the programming process.

Its powerful menu driven software makes the programming of eproms simple, efficient and eliminates the need to have fiddly switches for selecting eprom types, programming voltage or method. The features include:

- Integral power supply ensures no power drain from the computer.
- Interfaces through 1 MHz bus, fully buffered.
- Clear and simple instructions displayed on the screen make the programming easy for both the first time user and the advanced user.
- Eproms upto 16K (27128) programmed in single pass (27256 in two passes).
- Selectable programming voltage 25/21/12.5V
- Selectable programming method — normal or high speed algorithmic. High speed programming enables 27128 to be programmed in just over 2 mins. Normal programming skips addresses with FF data to increase programming speed. Automatic verification on completion of programming.
- User can select any section of the eprom from a single byte to its full address range to Blank Check/Read/Program/Verify enabling program development/changes very simple.
- Full screen editor with HEX/ASCII input.
- Data input from keyboard/Tape/Disc/Eprom.
- Software interface for integration of user's special requirements.
- Constant display of all options selected.
- Several BBC BASIC programs can be entered on a single eprom.
- Checksum facility allows for easy identification of programmed roms.
- Enter OS Commands from within the epromer program.

EPROMER II with Manual & Software on disc	£99 (b)
ROM image of software supplied on disc for use with sideways ram. ROM based software if required.	£5 (d)

UV ERASERS

UV1T Eraser with built-in timer and mains indicator. Built-in safety interlock to avoid accidental exposure to the harmful UV rays. It can handle up to 5 eproms at a time with an average erasing time of about 20 mins. £59 (b)

UV1B as above but without the timer. £47 (b)

MONOCHROME MONITORS

TAXAN

KX1201G 12″ HI-RES green etched screen	£90 (a)
KX1203A 12″ HI-RES amber etched screen	£105 (a)

PHILIPS

BM7502 12″ HI-RES green screen	£75 (a)
BM7522 12″ HI-RES amber screen	£79 (a)

ACCESSORIES

Microvitec Swivel Base (14″ plastic monitors)			£20 (c)
Taxan Swivel Base for mono monitors with integral clock			£22 (c)
Philips Swivel Base			£14 (c)
Monitor Stand. BBC B + B	£10 (c)	Master	£12.50 (c)
Double Tier Plinth. BBC B + B			£19.50 (b)
Taxan RGB Cable	£5 (d)	Microvitec RGB Cable	£3.50 (d)
Monochrome BNC/PHONO Cable			£3.50 (d)

TOUCHTEC-501

Designed for use with Microvitec metal cased monitors, and using the RS-423 socket, this unit brings genuine touch-screen operation to your BBC. Ideal for the educational users. Supplied with a users handbook and utilities disc containing starter programs and development software.

Touchtec 501 £255 (b)

PORTAL ROM EMULATOR

NEW

Real time evaluation of all listed eproms at 150 ns — hundreds of times faster than a typical eprom write/erase cycle (4Kbytes/sec, no erase time) — completely software driven (by Meta Assembler) — compatible with 'piggy-back' processors.

Don't blow an eprom each time you test your code on your target system! Use a PORTAL eprom emulator instead. Upto four independent PORTALS can be used on the same BBC lead. Each PORTAL has a length of cable with 28 pin header which plugs into the eprom socket you need to emulate — and thats it. All the rest is handled by META. Your code is sent down to PORTAL during assembly, with various options ie two PORTALS for 16bit data bus, sequential PORTAL skipping etc.

PORTAL is supplied in a custom steel case with 13 LEDs to indicate the state of its various functions. Comprehensive documentation and software are included.

Two versions of PORTAL are currently available.

PORTAL 128 (2716/2732/2764/27128)	£185 (b)
PORTAL 512 (all above + 27256 and 27512)	£285 (b)

Please send for detailed specification sheet

REAL-TIME CLOCK CALENDER

time-wasp
real-time clock

A low cost-unit, allowing the facilities of units costing far more. Built to professional standards, it opens up the total spectrum of Real-Time applications. Possibilities include desk diary/planner, calender, continuous display of on-screen time and date information, automatic document dating, precise timing and control in scientific applications — its uses are endless. Simply plugs into the user port — battery backup is supplied as standard. A full manual as well as extensive software including a simple demonstration diary/planner application program on disc. £29 (d)

ROM/RAM EXPANSION SYSTEMS

ATPL SIDEWISE ROM EXPANSION BOARD A well constructed expansion board, simple to instal and requires no soldering. All buses are buffered. It allows full sidewaysd rom expansion to 16 ROMs. One socket has been split into two 87K sockets to allow the use of 8K CMOS RAM. Battery backup option allows data retention in the RAM when the computer is switched off. Several link selectable options including write protect for the RAM. ATPL Board £37 (d) Battery Backup Kit £18 (d)

COMPUTER VILLAGE CV-16 Rom Board £38 (d)

A neatly designed, simple to instal board allows full sideways rom expansion on the model B. Two sockets for 8K CMOS RAM allow a total of 16K for which battery back is fitted as standard. £35 (d)

RAMROM-15 The advanced sideways ROM/RAM expansion system. This is an external unit, using high quality construction. attractively packaged in a BBC coloured metal case, allowing easy access to all the sockets. No soldering is required. Allows 11/12 additional sideways ROMs to be fitted with an option of up to 16K sideways RAM. All commonly available RAM can be used i.e. 4801/6116/6264 or xx128. Battery back-up fitted as standard. For development work and further expansion, most of the 6502 processor signals are available. Supplied with utility disc and full instruction manual. £79 (b)

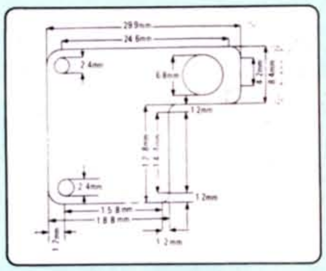
(Above boards are for use with standard BBC computer and not compatible with B plus unless specifically mentioned)

NOVACAD
Computer Aided Draughting for the BBC Micro

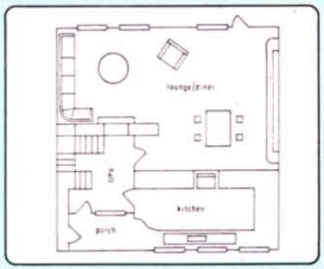
A sophisticated CAD package with unique facilities which until now were confined to custom built CAD packages.

Whether you want to draw a complex electronic circuit diagram or plan your new kitchen or simply draw a cube NOVACAD will help you do it better and more easily.

All you need is a BBC micro model B fitted with Acorn DFs and a single disc drive. If you have a 6502 2nd processor and a dual disc drive NOVACAD's capabilities are further enhanced.



- Very user friendly with all commands and controls from the keyboard. Special windowing techniques make available to the user almost one million dots allowing a lot more detail to be put on the drawing than one would normally expect the BBC to be capable of. The drawing can be 4 windows across and 5 up.
- Libraries of user defined ICONS such as electronic symbols can be created easily and edited even in the middle of drawing another diagram. ICON size is not limited to a number of pixels. An ICON can contain up to 500 lines, so complete drawings or sections of large drawings can be saved as ICONS for use with other drawings.
- ICONS can be called by name from a library into any part of the diagram and can be moved, enlarged, reduced, rotated in 90° steps and have mirror images made before being finally positioned.
- Shapes can be copied on the screen as many times as required.
- The zoom facility allows the user to magnify any section of a drawing by up to 20 times to make it easier to insert details.
- Horizontal and vertical displacements can be measured in any user defined scale.
- Any two colour can be used in mode 4.
- Up to '8 levels' can be used to produce multi layer drawings, and then user can decide which levels are to be displayed. This can be particularly used in pcb drawings, architectural drawings with details of the services behind the walls displayed only when required and many other such applications.
- Text can be added at any position vertically or horizontally.
- Use of 2nd processor will allow use of any 4 colours, higher pixel density drawings and considerably faster operation. (NOVACAD without the 2nd processor is faster than any other CAD package we have seen for the BBC).
- Powerful delete facilities allow deletion of single lines or whole sections with minimum of key presses.
- Printer dump for Epson compatible printers incorporated in the software which allows a full or a sectional screen dump.
- An optional plotter utility contains a plotter configuration program allowing the user to configure a program for his plotter. Pre-configured programs are included for Epson HI80, Hitachi 672, Penman, Plotmate and HP GL.



NOVACAD will prove to be an invaluable teaching aid in technical schools and colleges and for anyone involved in draughting it will be an ideal labour saving tool.

NOVACAD package with 16K ROM, Utility disc and a comprehensive manual £79 (c).

Novacd compatible with Tracker Ball/AMX Mouse £99 (c)

Stand Alone Mouse for use with NOVACAD £34 (d)

Upgrading of existing ROMs and DISCS £20 (d)

Plotter Utility Program £28.50 (d)

NEW META VERSION THREE

Now Available

- **Assembles for even more processors**
- **Now over 70k long on 2 Roms and 2 Discs**
- **Dozens of new options, features and directives**

The Original META system sold hundreds worldwide; it's being used in Universities, Polytechnics, British Telecom, the BBC, the MOD etc etc.

Now there's an even better version. It is supplied on two 16K roms and two discs and it is fully compatible with all BBC models including Master and gives you complete Editing and Assembly facilities for all the listed processors:

1802
HD 64180
Z80
6502 (including *all* CMOS varients)
65C812
65C816
6800
6802
68HC11
68000
8048 Series
8051 Series
8080
8085
Z8
68120
68121
6808
6301
6303
6305
6801
6803
6805
6804
6809

META uses the appropriate standard mnemonics for each, eg. LD (HL), 0ABH in Z80 and MOVE. B DO, $50(A5, D6.L) in 68000 etc.

Full nestable Macro facilities are provided, and nestable conditional Assembly, (IF/ELSE/ENDIF), Modular source code (including parameter passing). True local and global labels, 32 bit labels and arithmatic (incl. MUL, DIV, AND, OR, XOR, SHL etc). 30 ways to send object code during Assembly, including Intel Hex, S.Record, Binary etc to Disc files, RS423, EPROM emulators etc, local reassembly and over 50 directives, including DS.X, DC.X, EQUX, FCB etc).

Wordwise-style Editor integrated in with Assembler; Search/Search-Replace, Block copy/delete, markers etc; dozens of special features and functions for Assembly code programmer. Fast and Friendly to use.

Plus special new serial Communicator Area with Complex Option page etc.

Send for your detailed spec sheet on the META Assembler and the PORTAL EPROM Emulators. Set of disassemblers and Logic Analyser coming soon. £145 (c)

Please specify the computer type when ordering.

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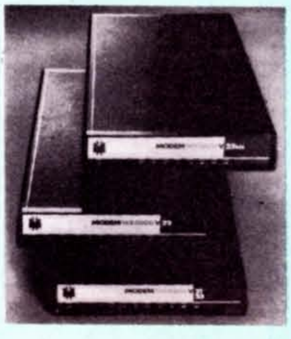
(d) £1.00

COMMUNICATIONS

MIRACLE WS3000 Range: * A new, professional series of intelligent modems with full auto dial and auto answer facilities as standard. * HAYES protocols are implemented allowing the use of a wide range of well proven communications software. 'Plain English' command structure simplifies the use of the modem even for the first time user. * All models feature a centronics compatible printer port allowing direct output to a printer. * A line sharing facility that allows WS3000 to differentiate between calls intended for data, and those for speech. * An intelligent speed buffered RS232 port and a wide range of available data rates makes this one of the most powerful multi speed range of modems available. * Line noise filtering ensures error free transmission and reception of data on long or noisy lines. * Internal battery backup allows storage of 63 names and telephone nos. * This range of modems can be factory fitted with high security data access protection system. * Models V2123 and V22 can be factory upgraded to V22bis standard giving a single compact modem capable of data rates from 75bps to 2400bps.

APPROVED for connection to telecommunication systems specified in the instructions for use subject to the conditions set out in them.



WS3000 V21/23: This modem complies with the CCITT V21, V23 and Bell 103 standards and operates at CCITT standards for 300bps, 75/1200bps, 1200/75bps full duplex, 600bps and 1200bps half duplex, and the Bell standard for 300bps full duplex. **£295 (b)**

WS3000 V22: This modem operates on all V2123 standards plus V22 standard for 1200bps full duplex V22bis standard. **£495 (b)**

WS3000 V22bis: This modem operates on all V21/23 and V22 standards plus 2400bps full duplex. **£650 (b)**

BBC Data Cable for WS3000
£6 (d) Data cables for other micros available.

NEW

WS4000/'SCHOOLS' MODEM, a new low-cost high performance 'Hayes' intelligent modem with A/Dial and A/Answer and V21/23 at **£149 (b)**
A **V22** upgrade can be added at **£250**, and **V22bis** at £405. Other options, all priced at £50 are battery backup, Bell standards, Call Monitor, Control port and Tone Dialling.
Please send for full details.

MIRACLES WS2000 This highly successful world standard modem, having BT approval, covering V21, V23, (BELL 103/113/108 outside the UK) and including 75,300,600, 1200 Baud ratings. What possible gives this modem its biggest advantage is its option of computer control. A 25Way RS232 input as well as possible computer controlled auto/dial/auto-answer makes this modem unique.

WS2000 £102 (c) Data Cable **£7 (d)**

WS2000 Auto-Dial card: includes an integral loudspeaker for monitoring of the phone line **£30 (d)**
BBC User Port cable (for modem control) **£4 (d)**

WS2000 Auto-Answer Card £30(d)
(Please note that the A/D & A/A Cards are still awaiting BABT Approval.)

SKI KIT (Allowing total control of the modem by your computer) **£10 (d)**

DS1 Disc (for Commstar): When used with the Auto-dial card, SK1 Kit, and a user port cable, this software will dial out to Prestel, enter your password etc. and leave you in Commstar. Will also store many bulletin board telephone numbers and protocols for autodialling **£10 (d)**

GEC DATACHAT 1223 Modem: An economically priced BABT approved modem complying with CCITT V23 standard capable of operating at 1200/75bps and 75/1200bps and 1200/1200bps pseudo full duplex. It is line powered does not require external power source. It is supplied with software suitable for connecting to PRESTEL, Micronet 800, Telecom Gold and a host of bulletin boards. **£75 (b)**

SPECIAL OFFER

As reviewed in June issue of Acorn User
'Worthwhile and above all easy to use package'

COMMUNICATIONS SOFTWARE

DATA-BEEB An advanced communication ROM from Miracle Technology. Its many features include both Viewdata (Prestel) and Terminal modes, Auto-Answer and Auto-dial for fully expanded WS 2000's etc. Macro facilities allow flexible use of its many facilities e.g. automatic dialling, log-on, going to a specific page, printing it, and going off-line, all in one operation. **£24 (d)**

TERMULATOR An advanced terminal emulator on a 16K Rom. Emulations include VT52/100, Tektronix 4010 etc. Allows a BBC to be used as a terminal for almost any mainframe computer or computer network. **£25 (d)**

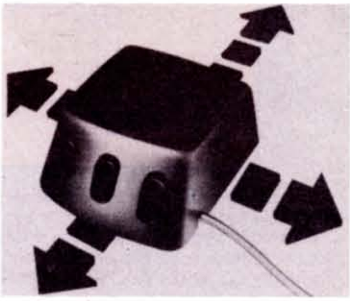
COMMUNICATOR This is a full 80 col VT100 terminal emulation program on 16K eprom. It is a more advanced program than TERMI and features easy to follow screen menus. The rate at which data is sent or received is easily set up with rates up to 19200 Baud with 80 column text. Allows files to be transmitted from disc, or a copy of incoming data to be sent to a file or to a printer. (Communicator is not suitable for PRESTEL). **£49 (d)**

RS232 Solution (Book) **£15.95 (c)**

COMMSTAR An ideal communications rom for both Prestel and bulletin boards. Facilities include Xmodem, clock etc. **£28 (d)**

RS232 Solution Book **£17.95 (c)**

AMX MOUSE with SUPERART



The mouse will now be available with enhanced software, the 'SUPER ART' which is compatible with 6502 2nd processor, the ARIES RAM board, BBC+ shadow mode, tape and ACORN DFS and ADFS. Allows full use of colour in mode 1. Disc users can create colour pictures in A4 size with dot pattern editing, use of icons, additional text styles, superb zoom in colour.
There is a variety of optional software to make the mouse one of the most versatile peripherals that can be added to the BBC micro.

AMX Mouse with Super Art £67 (d)
AMX Super Art Package on its own £43 (d)

AMX PAGEMAKER provides a high resolution A4 Typesetting and Artwork system. **£43 (d)**

AMX 3D ZICON will let you transform three dimensional vector data and translate them into 3D on screen graphics. £21 (d)

AMX DATABASE is a new filing system with 1000 records per file and unlimited number of fields per record. £21 (d)

Fleet Street Editor £38 (d)

RB2 TRACKER BALL

A precision built tracker ball. Software allows RB2 to function instead of cursor keys, for word processing, CAD/CAM etc. Software includes a graphics/CAD package.

RB-21 (with 'icon artmaster'). £59 (c)
16K ROM for cursor control on the Master computer. £12.50 (d)

BBC COMPUTER SPARE PARTS

Complete Keyboard	£52	UPD7002	£5.00
Power Supply Unit	£52	DS3691	£3.50
Keyswitch	£1.75	7438	£0.40
Keyboard Connector	£4.00	74LSOO	£0.24
Video ULA	£18.00	74LSO4	£0.24
Serial ULA	£14.00	74LS10	£0.24
UHF Modulator	£4.50	74LS123	£0.80
6502A 2MHz CPU	£6.50	74LS163	£0.75
65C02 CMOS CPU	£12.00	74LS244	£0.80
6512AP CPU	£12	74LS245	£1.10
6522 VIA	£3.50	74LS373	£0.90
6522A 2MHz VIA	£5.50	74LS393	£1.00
LM3 24 op-amp	£0.45	8271	£46
SAA 5050-Teletext	£9.00	88LS120	£3.00
6845SP CRT Controller	£6.50	4464 RAM	£8.00
		O/S Basic B +	£25

All the above carry Carriage Code (d)

MERLIN

MERLIN is the ultimate utility ROM for the BBC and BBC PLUS (Master coming soon) — an optimum combination of the most useful, of Disc, Memory, and ROM management utilities. A total of no less than 57 essential commands ensure that this will be the last utility ROM you will purchase. It is suported by a 106 page comprehensive manual with detailed syntax, argument and error messages for each command, and all the utilities are fully 'Tube' compatible.

A selection of just some of the commands include:

APPEND — append Basic files
ARCHIVE — a unique disc/tape archive system
CDIS — a 6502/65C02 disassembler, also able to disassemble sideways
ROM/RAM and optional printer output.
CLONE — protected disc copier.
DBYTE — Disc byte search utility.
DSTRING — disc string search utility allowing localised string search.
DUAL/SWAP — allows second catalogue on disc for 60 files/side of disc.
EDSEC — an interactive disc editor, able to directly access sectors, read and write to sectors marked deleted, and editing of protected discs.
FORM — a formatter able to format all or part of disc.
GPACK/GEXPAND — an all-mode screen file compacter/expander enabling saving of upto 70% of screen memory.
MBYTE/MSTRING — memory byte/string search utility.
MEDIT — interactive memory editor.
REPAIR — atempts to recover data from a track and repair.
ROFF — disable a ROM.
SEDIT — interactive 'protected-disc' editor.
ZDUP — disc backup/format utility for ACORN & TORCH Z80 users.

As there are so many new commands, we have prepared a detailed leaflet describing all the commands — this is available on request.

MERLIN £37.50 (b)

FIRMWARE AND SOFTWARE

LANGUAGES

META-ASSEMBLER: For full details please see page 6 of this advertisement.

6502 DEVELOPMENT PACKAGE A Macro-Assembler with utilities for use with the 6502 2nd Processor. Enables the serious programmer to develop large programs in assembly language. £39 (d)

ACORN MICRO-PROLOG: The logic programming language seen as the language for programming in the future and used extensively in the artificial intelligence field. A simple 'front end' is supplied to make syntax more user friendly for new users. 16K Rom, manual and extension modules. £62 (c)

ISO-PASCAL Acorn's full implementation of International Standard Pascal on two 16K ROMs. Disc Version for use on 6502 2nd Processor also supplied. Comprehensive manual. £47 (c)

ISO PASCAL Stand ALONE GENERATOR: Utility to convert programs produced using ISO PASCAL for stand alone applications. £28 (d)

ACORN LOGO A full implementation of the Logo language from Acornsoft. Supplied as two ROMs with a tutorial course and technical manual. £42 (b)

LOGOTRON logo £56 (c)

BCPL A full implementation of the BCPL compiler language consisting of the language of ROM, disc containing the BCPL compiler, a screen editor, a 6502 assembler, other utilities and programming aids and examples of BCPL code and a 450 page manual. £42 (b)

BCPL CALCULATIONS PACKAGE Supplied on disc, it supports floating point, fixed point and fast integer calculations. It includes the BCPL calcultion files, example files and a comprehensive user guide. £15 (d)

BCPL STAND ALONE GENERATOR £36 (d)

Acorn LISP Rom, Acorn FORTH Rom, Acorn COMAL, (each) £39 (d)

MICROTEXT A frame based authoring system from National Physical Laboratory for interactive computer tutoring. Disc based. **Disc** £49 (c)

OXFORD PASCAL A fast, compact P-Code compiler, that fully utilises BBC Graphics and sound, contains a powerful editor, and produces 'standalone' software. (Specify 40/80T) £35 (c)

DATABASE MANAGEMENT SYSTEMS

VIEWSTORE	£37 (d)	**MASTERFILE II**	£17.00 (d)
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EDWORD II	£42 (a)		

SPREADSHEETS

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VIEWPLOT: A disc based Linear graph/barchart/piechart plotting program. £25 (d)

INTERSHEET The new spreadsheet from Computer Concepts. Many advanced facilities including 105 character display, several spreadsheets may be used at once, may be used with View & Wordwise etc. etc. £45 (c)

INTERCHART Graphics Package for the Intersheet. £30 (d)

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Acorn FORTH	£7.50
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S-PASCAL	£7.50
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EDUCATIONAL SOFTWARE

We are pleased to announce that we now stock the full range of BBC Publications Educational software for the BBC computers. This software which is in many cases developed alongside radio and TV programs from the BBC Education Department, has all been tested in many schools, and by education experts to ensure the high quality one would normally expect from BBC. These packages supplement the class room learning by providing moving and colourful graphical displays which normally cannot be easily produced on the blackboard and help in ensuring clear understanding of a variety of subjects. The software has received wide acclaim from teachers, and in the educational press. All cassette programs transfer easily to disc, and all disc programs can be run on 40 or 80 track drives.

PRIMARY LEARNING

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⌒ ▣ **EC £17 (c)**

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DRAWSTICK **£8.50 (d)**

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INSIDE INFORMATION
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OPEN LOGO
Developed by the Open University to provide a full implementation of Logo — the language of learning — for the BBC Micro. 2 × 16K ROMS and two detailed manuals (120pp and 300pp)
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£7

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Mapping out the answers

IN my fifth year at secondary school the geography master and I came to the amicable agreement that he would not waste my time trying to teach me geography if I would not waste his trying to learn.

My problem was that I was incapable of visualising a map and then putting it down on paper.

So when I found that adventure games needed a map I began to panic. My first efforts were fantastic: I used up sheet after sheet of paper, drawing little boxes that were connected by a tangled web of lines just like spaghetti and meatballs.

At the end of it all I was still no wiser as to where I was in the game, where I'd come from or where I was likely to go to.

Nowadays I construct a logical rather than a pictorial map. A good many other adventurers have taken the same course which is not surprising since there are few alternatives to a pictorial map.

I give every location a number and follow this with a precis of the description, a list of the exits given and the result of moving in a particular direction. Usually the result is another location number and so the process starts all over again.

To begin with I make notes on paper, but once I have described 20 or so locations I create a Wordwise Plus file and store it on disc. When the locations have reached the 100-plus mark I make a printout and simply use rough paper for updating the notes until the mapping is complete.

I then file a printout for record purposes. As part of the description it is vital to note down the location of any objects that are going to be needed later on in the game.

I speak from my bitter experience. In Village of Lost Souls I noticed a bucket and later thought it may come in useful for firefighting, but found I hadn't made a note of where it was on the map. It took two trying hours to find, combing every single location I'd visited. I try to make a note of the object's possible function as well. This comes in useful when planning your problem-solving strategy even if you find your first guess is wrong.

by
The
Mad
Hatter
10/6

Before I leave the business of mapping for this month Table I is a sample of how I mapped the first few locations in Red Moon.

Remember I shall not give clues or answers to problems in any kind of code, so you'll just have to exercise monumental self-restraint and skip this bit if you want to remain ignorant.

I intend to have a monthly section dealing with problems and ways of tackling them so that newcomers to adventuring can discover different techniques quickly.

My most vexing problem in Red Moon was when I came to a door guarded by a dog and I had to work our how to get past. This is a common type of problem – the knight in Quondam is another example.

There I was, the fond owner of a great big soppy Golden Retriever, puzzling what to do with this confounded animal. I tried stroking, patting, and petting it, but all to no avail.

I tried to entice him with the juicy piece of meat – DROP MEAT, GIVE MEAT, FEED DOG and every other combination I could think of – but the perishing pooch managed to gobble up the meat while still keeping guard.

Gradually the sick truth dawned that the pooch was truly in need of perishing. So the poison pill was taken, put into the meat, the dog fed and that was that.

This is a typical example of a chaining problem: several items have to be combined to give a final solution – literally in this case. By the time I discovered that there is a less ruthless way into that part of the castle it was too late.

A couple of months ago I warned you

→

Room	Description	Exits	Move	Result
001	Flat grassy plain	Steep rock slide Pothole Grassy mound Grassy mound	N E S W	002 005 015 015
002	Steep rock slide	Flat grassy plain Sheep tracks Stony path	S SE NW	001 003 013
003	Sheep tracks	Castle gateway Pothole Steep rock slide	NE S NW	004 005 002
004	Castle gateway (locked) "Beware Rat" (key at 009)	Castle entrance Sheep tracks	NE SW	011 003

Table I: Mapping the first few locations in Red Moon

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RAM 6264LP-15 8K	3.95
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Linear Graphics Plotmate	343.85
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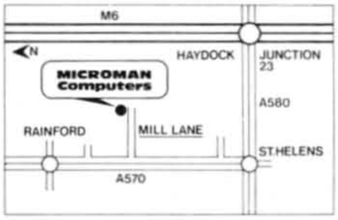

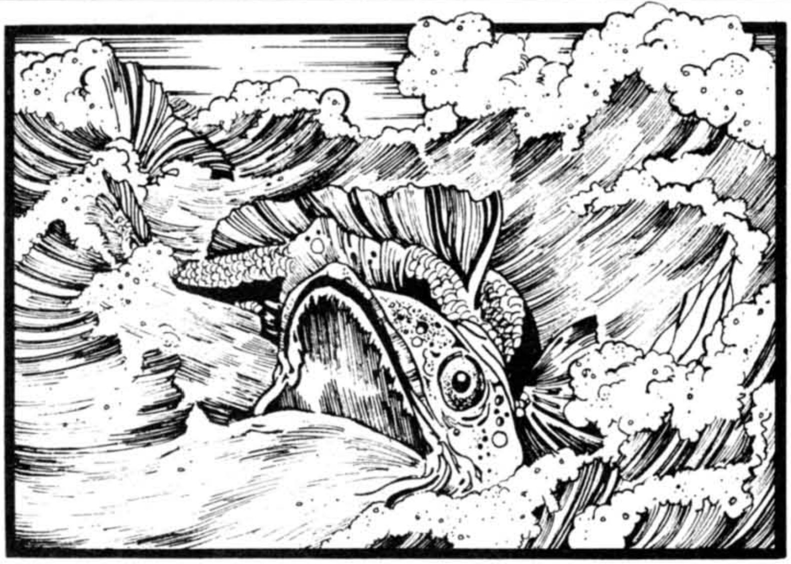

From Page 67

to be on the lookout for more news of the new adventure software house Magus. I have received pre-release copies of two games from them, and by the time you read this they should be on the market.

They are both smaller and cheaper than Village of Lost Souls, and are in BBC and Electron versions with a disc option for the BBC Micro. What's Eeyore's is £5.95 on tape and £7.95 on disc and Locks of Luck is £6.95 on tape and £8.95 on disc. As with the cheaper Level 9 games don't make the mistake of thinking cheaper is inferior.

In its covering letter Magus wrote; "Both programs are intended as light relief for the seasoned adventurer to relax with, after a more serious gaming session", and that sums them up perfectly.

A preliminary look had bellows of laughter coming from me, and shouts of "Shut up" from the rest of the family. If you don't like puns stay well away from these games. If you do like them extracts follow to give the flavour.

A loading screen displays the title What's Eeyore's, and after a bit up comes the flashing response "Thanks, I'll have a pint". Later the scenario is set as follows – Eeyore's tail has gone missing again and his moaning is making everyone miserable.

In desperation King Golly and his wife Queen Sindy (what a doll she is) are offering the hand of their daughter Tiny (who's a bit tearful) in marriage to the toy that can reunite Eeyore with his tail.

As Joe, one of the GIs (Gollies Infantry) in the palace guard, you decide to try your luck on the quest. You must collect 12 treasures as well as re-attach Eeyore to his tail.

This is a typical scene – you are in a quiet country lane, dogroses bark at you and belladonna is looking for a bell to wear. You see a small dark bottle and a snake in the grass. So EXAMINE BOTTLE and you discover a Guinness label.

Being a law abiding citizen I couldn't think what to do with the label, so I tried DRINK GUINNESS, only to get a null response. The description didn't indicate that the bottle was tightly stoppered or empty, so a couple of marks off for that.

EXAMINE SNAKE produces the information that it's covered in little crosses so TAKE ADDER, and so on. There are some interesting chaining puzzles that depend for their solutions on lateral thinking and a taste for excruciating puns.

I'm a country hayseed at heart, so when I found a hen with copper terminals under its wings I knew how to give myself free range abilities.

I certainly found it a good adventure to relax with, though I think its appeal for younger adventurers may be limited unless they are quick witted, and widely read in nursery rhymes – old codgers like me go to bed reciting them, so we have a head start.

Locks of Luck (and you'll need it) is a sequel to Eeyore. King Golly's dreadlocks have been stolen by Sahara the Sandwitch and Joe is entrusted with the task of killing the witch and collecting the odd item of loot – I suppose it is only logical that the heir to the throne should save the hair to the throne.

When I found a cuddly toy that turned out to be a reddy teddy I just had to type in REDDY TEDDY GO to see what happened, but nothing did. It turns out that I missed a letter or two out of the last word – it's a "let there be light" bear.

However, when I came across a dachshund (EXAMINE) and found that it had bread coloured fur and smelt of onions. I wasn't too surprised to find I had to drop it after one move because it was a hot dog.

This game has two valuable aids for newcomers: HELP will display a list of recognised verbs, and there is a facility for sending data to both printer and screen which will help in mapping the game.

There are some superb puzzles in both of these bargain games and, praise be, there is not a single maze. At the moment they are available by mail order only from Magus, 4 Toronto Close, Durrington, Worthing, West Sussex BN13 2TD.

Here are some questions and answers from readers concerning Melbourne House's, Terrormolinos. George Carey wants to know who is missing at the monastery, how you get on the coach when you want to leave and how you return from the wine tasting trip – over to you folks.

David Field has some Terrormolinos tips – firstly to get rid of the bull lead him into the china shop. Secondly, after taking a successful photo at the monastery you need to search the catacombs until you find Mr. Snargsby – this sounds like the answer to George's first question. Thirdly to kill the shark type FIRE HARPOON, and finally enter the Tardis.

Liz Rudling has a tip for would-be photographers. You can only get the film for the camera in Terrormolinos itself, so go NW from the Plaza after leaving your suitcase in your hotel room. The funny thing is that Liz has had problems with that bull.

This shows how we all have our different blind spots, and that we need help from each other. Myself I am not afraid to shout for help publicly, as you'll find out in time. Snowball had me completely foxed until Alice helped out with the colour codes. See you next month. Happy adventuring.

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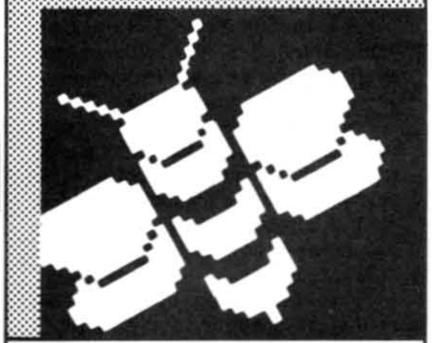

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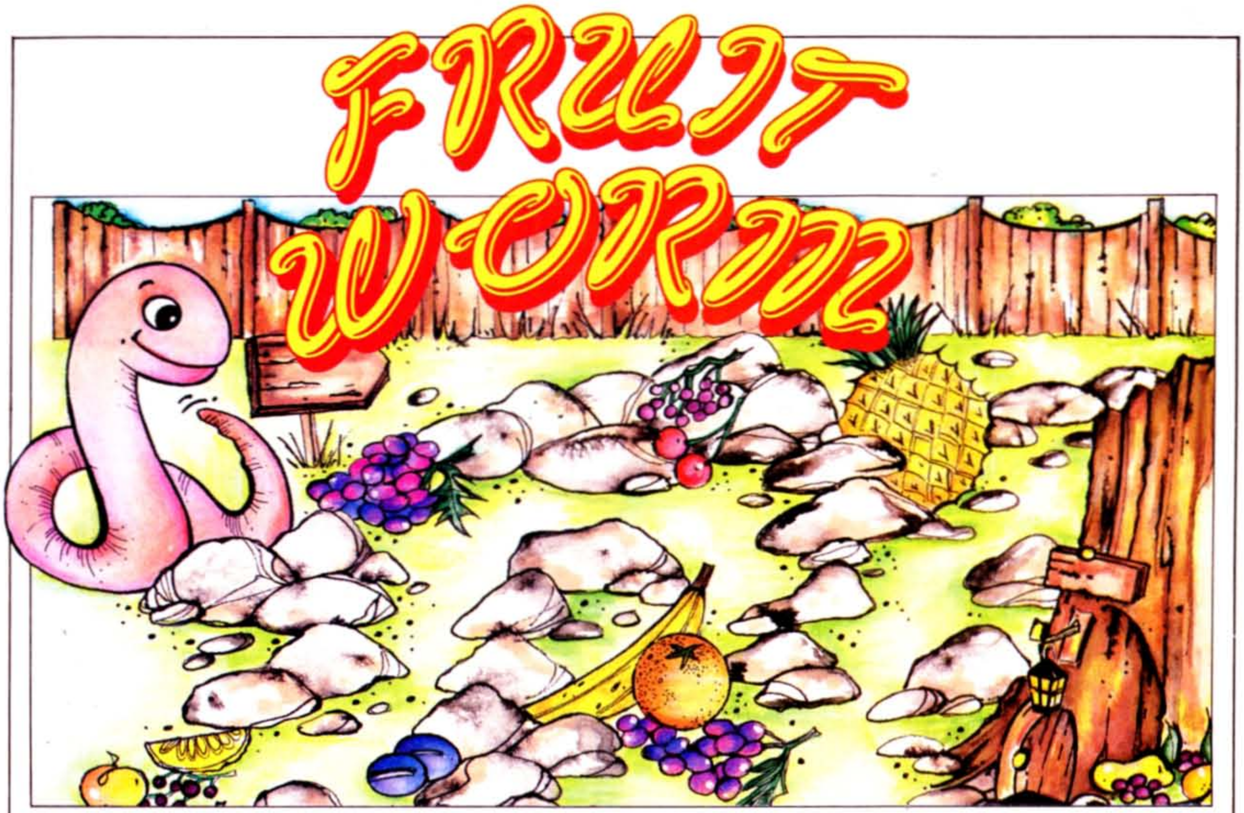
FRUIT WORM



By CARL DUNKLEY

LIFE isn't what it used to be in Lady Chatterley's garden. Ever since the gardener got the sack the place has become overgrown with an assortment of fruit and vegetables, and is littered with a variety of cast off items of equipment.

Even some of the musical notes from her ladyship's afternoon string quartet sessions have been left lying around the place.

But life has to go on for a fruit worm, and one distinct advantage in the situation is that food is in abundance. But so are the hazards.

The object of the game is to guide Egba the worm around the screen eating the apples, cherries, flower pots and musical notes while avoiding everything else that is left lying around.

These include mushrooms and the wall that surrounds the garden, and be warned – one touch is fatal. The wall only runs across the top and bottom of the screen and you'll find it useful to be able to go off one side and come back on the other.

Just to make life a little more awkward there is a time limit on your munching activities, and should the clock run out once again it's curtains.

But to a greedy little worm like Egba this shouldn't prove to be too much of an obstacle until some of the later screens, which tend to get rather full.

As you clear each part of the garden a bonus is awarded dependent on the actual frame number and the time remaining on the clock. You can recover lost lives at the rate of one for every 50,000 points you manage to score.

The program is quite greedy on memory and will download if necessary to &E00 when you run it. As it also contains quite a lot of machine code you would be well advised to save it before running it.

Full listing starts on Page 95

KEYS	
Z	Left
X	Right
*	Up
?	Down
P	Pause

FUNCTIONS

text	Print using different fonts.
f	Print score.

PROCEDURES

initialise	Set up envelopes and arrays.
titles	Instructions.
screen	Draw screen.
freeze	Print Freeze and wait for call pause.
pause	Wait for key press.
wait	Play a tune while waiting for a key press.
dead	Dead subroutine.
bonus	Bonus subroutine.
print	Print large characters.
assemble	Assemble machine code.
table	Display high score table.
swap	Update high score table.
exchange	Swap names and scores.
locate	Find an empty square.
input	Input name.
colours	Display screen.
black	Blank out screen.
erase	Erase worm.
scroll	Move screen.

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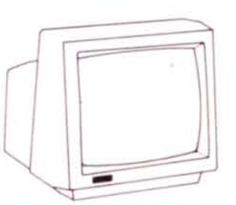

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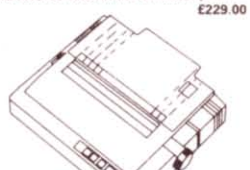

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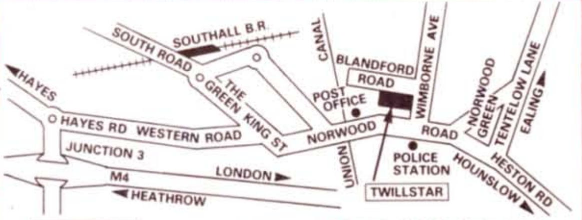

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How much it costs to use MicroLink

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Software over the telephone

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What you need to access MicroLink

You must have three things in order to use MicroLink: a computer (it can be any make of micro, hand-held device or even an electronic typewriter provided it has communications facilities), a modem (it can be a simple Prestel type using 1200/75 baud, or a more sophisticated one operating at 300/300 or 1200/1200 baud), and appropriate communications software.

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Making the most of your ink jet printer

JIM NOTMAN provides three routines for the Olivetti JP101

ALTHOUGH the Olivetti ink jet printer has been around for a while it has recently undergone an upgrade in popularity. This is probably related to recent price cuts which make the printer much more affordable.

Unlike many other printers at the cheaper end of the market it is a matrix printer which prints all its characters as a series of dots. The more common impact dot matrix printers have a print head with a number of small pins which strike a printer ribbon in order to mark the paper.

When they do so they also manage to create a considerable amount of noise. However the Olivetti printer is far quieter. Instead of small pins it sends a high voltage spark to an ink cartridge, which causes a small jet of carbon to be shot out directly on to the paper.

This accounts for the slightly carbon-copy appearance of the text. The quietness of the printer means that you can use it at the dead of night without disturbing the whole neighbourhood. Before the insomniacs amongst you can take advantage of this, you'll need to get to grips with the manual.

For instance the manual gives the command to print double height characters as ESC ' (1/11–2/7). What this means is that the Escape character must be sent to the printer followed by a ' character. The figures in the brackets refer to the actual Ascii value of the code which is given in a rather strange form of hexadecimal.

Normally 1/11 would be expressed as &1B, which is equivalent to 1 * 16 + 11 = 27, the Escape character. The other code will be 2 * 16 + 7 = 39, which is the code for the ' character. To save you time the more common codes are given in decimal numbers in Table I.

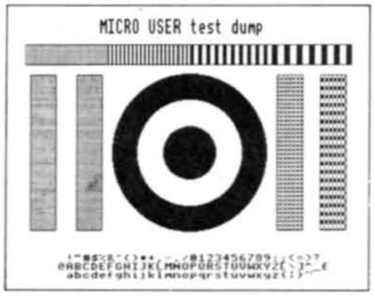
In Wordwise these codes can be included in the text following the OC command. In a Basic program they can be sent to the printer with a VDU 1 before each part of the code. A short program demonstrating some of the features is given in Program I.

Command		Codes
set 10 pitch		27,19
set 12 pitch		27,61
set 18 pitch		27,20
1/6" vertical spacing		27,71
1/8" vertical spacing		27,72
zoom (graphics only)		27,47
reverse (negative graphics)		27,45
	On	**Off**
double width	27,14	27,15
double height	27,39	27,37
normal underline	27,42,48	27,43
double underline	27,42,49	27,43
dotted underline	27,42,50	27,43

Table I: Printer commands

The following two programs are printer dumps which will print out a screen picture which has been previously saved to tape or disc. When saving and loading a screen make sure that there has been no scrolling of the screen otherwise it will have a rather mixed up appearance.

Table II gives the start address and length of screen memory for each graphics mode. For a simple, no frills printer dump for Modes 1, 2, 4 and 5 see Program II.



The size of dump produced by this program is quite small, about 2⅞in by 2⅛in. Making this dump larger is very easy with the ZOOM command which doubles the size of the paper image with the same graphics data. To do this add this extra line:

```
125 VDU 1,27,1,47
```

Once the graphics control string has been sent the printer will expect all the screen image data to follow. If you press Escape before completing the screen dump you will need to reset the printer by switching it off and on.

Program III extends the screen dump to cope with Mode 0 and to check whether Escape has been pressed after every eight rows of pixels producing the larger paper image. The drawback is that it is slightly slower than Program II.

→

Program I

```
   10 REM TEST Inkjet features
   20 REM Jim Notman
   30 ON ERROR VDU3:REPORT:PRINT "at
line ":ERL:END
   40 VDU2
   50 PRINT"Different pitches"
   60 VDU1,27,1,20
   70 PRINT"This should be 18 pitch"
   80 VDU1,27,1,61
   90 PRINT"This should be 12 pitch"
  100 VDU1,27,1,19
  110 PRINT"This should be 10 pitch"
  120 VDU1,27,1,39
  130 PRINT"This should be double hei
ght"
  140 VDU1,27,1,37
  150 PRINT"This should be normal hei
ght"
  160 VDU1,27,1,14
  170 PRINT"This should be double wid
th"
  180 VDU1,27,1,15
  190 PRINT"This should be normal wid
th"
  200 VDU1,27,1,42,1,48
  210 PRINT"This should be normal und
erlining"
  220 VDU1,27,1,42,1,49
  230 PRINT"This should be double und
erlining"
  240 VDU1,27,1,50
  250 PRINT"This should be dotted und
erlining"
  260 VDU1,27,1,43
  270 PRINT"This returns to no underl
ining"
  280 VDU3
```

From Page 77

Program II

```
   10 REM S.Inkjet
   20 REM Simple Screen Dump for Oliv
etti JP101
   30 REM Jim Notman
   40 MODE 4:REM or Modes 1,2,or5
   50 INPUT "Name of screen file ",fi
le$
   60 A$="LOAD "+file$:DIM L% 16:$L%=
A$:X%=L% MOD 256:Y%=L% DIV 256:CALL &
FFF7
   70 PROCinkjet
   80 END
   90 DEFPROCinkjet
  100 DIM V% 7
  110 FOR I%=0 TO 7:V%?I%=2^(7-I%):NE
XT
  120 VDU2
  130 PROCsend(CHR$(27)+"G120;40;32;2
"+CHR$(27)+"Z")
  140 FOR Y%=1023 TO 0 STEP -4
  150 FOR X%=0 TO 1279 STEP 32
  160 P%=0
  170 FOR B%= 0 TO 7
  180 IF POINT(X%+B%*4,Y%)>0 THEN P%=
P%+V%?B%
  190 NEXT B%
  200 VDU 1,P%
  210 NEXT X%
  220 NEXT Y%
  230 VDU 3
  240 ENDPROC
  250 DEFPROCsend(s$)
  260 FOR I%=1 TO LEN(s$)
  270 VDU 1,ASC(MID$(s$,I%,1))
  280 NEXT
  290 ENDPROC
```

Program III

```
   10 REM Inkjet
   20 REM Screen Dump for Olivetti JP
101
   30 REM Jim Notman
   40 ON ERROR GOTO 110
   50 INPUT "Which screen mode ",mode
   60 MODE mode
   70 INPUT "Name of screen file ",fi
le$
   80 A$="LOAD "+file$:DIM L% 16:$L%=
A$:X%=L% MOD 256:Y%=L% DIV 256:CALL &
FFF7
   90 PROCinkjet(32)
  100 END
  110 VDU3
  120 REPORT
  130 END
  140 DEFPROCinkjet(rows%)
  150 A%=135
  160 mode=(USR(&FFF4)AND&FFFFF)DIV&1
0000
  170 IF mode=3 OR mode=6 OR mode=7 T
HEN PRINT "Not a graphics mode":ENDPR
OC
  180 DIM V% 7
  190 FOR I%=0 TO 7:V%?I%=2^(7-I%):NE
XT
  200 IF mode=0 THEN width$="8":xinc=
2:yinc=3 ELSE width$="4":xinc=4:yinc=
2
  210 cmd$=CHR$(27)+"G120;"+width$+"0
;1;"+STR$(yinc)+CHR$(27)+"Z"
  220 *FX229,1
  230 VDU2
  240 Y%=1023
  250 FOR R%=0 TO rows%-1
  260 IF mode <>0 THEN VDU1,27,1,47
  270 PROCsend(cmd$)
  280 FOR K%=0 TO 7
  290 FOR X%=0 TO 1279 STEP 8*xinc
```

Screen Mode	0	1	2	4	5
load address	3000	3000	3000	5800	5800
length	5000	5000	5000	2800	2800

Table II: Disc file info

	0	1	2	4	5
X resolution	640	320	160	320	160
Y resolution	256	256	256	256	256

Table III: Screen mode

40 Sets screen mode.

50-60 Load picture file.

100-110 Groups of eight pixels need to be gathered together into one byte for the printer. Each bit in the byte has a different value depending on its position within the byte. These two lines set up a small table so the value of each bit can be looked up.

120 Enables printer.

130 Sets up the graphics dump information string. This is made up of a number of different elements. Apart from Escape all the other characters sent to the printer are printable Ascii codes, as follows:

- Escape G, set up graphics printing.
- Set the width of the left margin in number of dots wide. The printer can have a maximum of 880 dots in a row. The number of separate pixels on each screen row depends on the screen mode – see Table III. The maximum possible number in a screen row is 640 in Mode 0. Allowing an equal margin at each side we can set the left margin to 120 dots.
- Set the width of the horizontal image width in bytes. In Modes 1 and 4 each horizontal row is made up of 320 pixels, which is equivalent to 40 bytes of information.
- Set the number of vertical rows in bytes. The vertical resolution is 256 pixels which is equivalent to 32 bytes.
- The vertical spacing of the rows is controlled by this section of the command. The value of 2 gives the same vertical spacing of dots as horizontal spacing. A value of 1 makes the rows closer together, and higher values place them further apart.
- Escape Z signals the end of the command.

140-150 Set up row and column loop counters.

160 Resets the value of the byte to be sent to the printer.

170-190 Collect together eight individual points to form one byte for transmission to the printer.

200 Sends the graphics byte to the printer.

230 Disables the printer.

250-290 Send the command string to the printer one character at a time with VDU 1,char.

```
  300 P%=0
  310 FOR B%= 0 TO 7
  320 IF POINT(X%+B%*xinc,Y%)>0THEN P
%=P%+V%?B%
  330 NEXT B%
  340 VDU 1,P%
  350 NEXT X%
```

```
  360 PRINTTAB(0,32-Y%DIV32-1);
  370 Y%=Y%-4
  380 NEXT K%
  390 IF INKEY(0)=27 THEN VDU3:PRINT"
Screen dump stopped":R%=32
  400 NEXT R%
  410 VDU3
```

```
  420 *FX 229
  430 ENDPROC
  440 DEFPROCsend(s$)
  450 FOR I%= 1 TO LEN(s$)
  460 VDU1,ASC(MID$(s$,I%,1))
  470 NEXT
  480 ENDPROC
```

90	Calls the screen dump procedure.
140	Start of screen dump procedure. The number of screen rows to dump is now included, so that it is possible to dump part of the screen.
150-170	Check the current screen mode. If it is not a graphics mode print a message and leave the procedure.
180-190	Initialise the look-up table for the various bits of the graphics byte.
200-210	Construct the graphics command string, depending on the current screen mode.
220	Switches off the normal action of the Escape key.
230	Enables the printer.
240	Initialises the Y coordinate counter.
250	Sets the row counter.
260	If it is not Mode 0 sends the ZOOM command to double the size of the picture produced.
270	Sends the command string.
280	Each character row is made up of eight screen pixel rows. Sets up a loop for these.
290	Sets the loop counters for X coordinates.
300	Resets the graphic information byte.
310-330	Combine eight separate pixels into one picture byte.
340	Sends the byte to the printer.
360	Moves cursor on the screen.
370	Decrements the Y coordinate count.
390	Checks whether Escape has been pressed. Sets the row counter past its maximum value to end the loop if it has.
410	Disables printer.
420	Re-enables normal Escape key action.
440-480	Send the command string to the printer.

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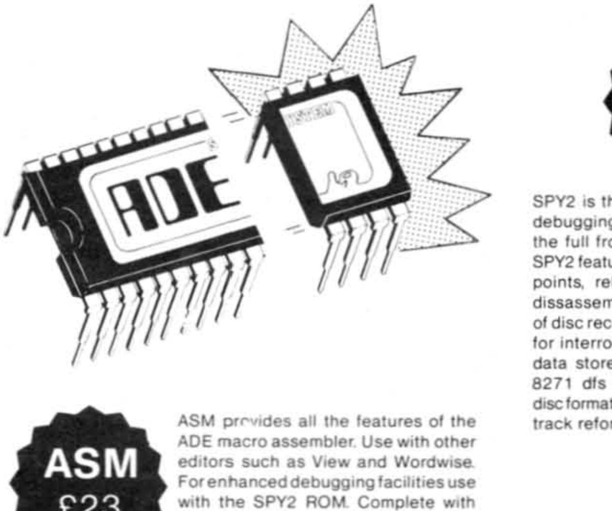

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Teach yourself hash searching

JOHN TISSANDIER demonstrates a speedier method than those slowcoach linear and binary search routines

COMPUTERS, just like people, spend a good deal of their time looking for things, like searching a table of information for a particular item.

The simplest method is to use a linear search but it is not very efficient. If the table is stored in an array it involves starting at the beginning of the array and comparing each element in turn with the search item.

This continues until either the search is successful or the end of the array is reached. On average a linear search involves n/2 steps, where n is the number of items in the table.

Program I is a simple demonstration of the idea using various years as the data. Those of you with an astronomical bent will know what they all have in common.

The worst case situation is when the item we are looking for is not in the table. Then we have to look through the whole lot. For 100 strings this would take about half a second and for 2000 about 8 seconds.

If the table is long and the searches frequent we need a more efficient method. Such a method is the binary search. However, whereas in the first method the order of the items is irrelevant, here the table must be in alphabetical order in the case of strings, or according to size in the case of numerical values.

We examine the item approximately in the middle of the sorted table. If, for example, the search item comes before this middle item then we can safely ignore the second half of the table, as we can be quite sure it won't contain what we are looking for. The above process is now repeated on the first half of the table and so on.

Therefore the area of the table being searched is repeatedly halved until either the search is successful or the area becomes zero. In the latter case we conclude that the search item is not in the table.

Program II demonstrates a binary search for strings, using the letters A to Z as the data.

Although a binary search is more efficient than a linear one there is a drawback. If new items are added to the table it must be re-sorted, and sorting is usually a lengthy business.

Luckily, there is a third method called hash searching, which is fast and in which the table does not need to be sorted.

How does it work? The best way to find out is to type in Program III. This has been written so as to reveal its inner secrets to you in a painless manner.

Once you have understood the technique you can delete the tutorial aspects of the program and make it purely functional.

To tempt you, let me tell you that on average the third method will cope with the worst case situation mentioned earlier for 1,000 strings in half a second.

Fairly frequently the search will be completed in only *one* step. So type on . . .

If you have now typed in Program III you will find the following easier to understand. On running the program the screen should display the title and a

→

```
   10 REM Program I
   20 REM Linear Search Demo
   30 n=5
   40 DIM table(n)
   50 FOR item=1 TO n
   60 READ table(item)
   70 NEXT
   80 INPUT "Search for which item",t
arget
   90 pos=0:found=FALSE
  100 REPEAT
  110 pos=pos+1
  120 IF table(pos)=target THEN found
=TRUE
  130 UNTIL found OR pos=n
  140 IF found THEN PRINT "Found at p
osition ";pos ELSE PRINT "Not found"
  150 END
  160 DATA 1066,1682,1759,1910,1986
```

Program I

```
   10 REM Program II
   20 REM Binary Search Demo
   30 n=26
   40 DIM table$(n)
   50 FOR item=1 TO n
   60 table$(item)=CHR$(64+item)
   70 NEXT
   80 INPUT "Search for which item",t
arget$
   90 found=FALSE:start=1:end=n
  100 REPEAT
  110 mid=(start+end) DIV 2
  120 e$=table$(mid)
  130 IF e$=target$ THEN found=TRUE
  140 IF e$<target$ THEN start=mid+1
  150 IF e$>target$ THEN end=mid-1
  160 UNTIL found OR start>end
  170 IF found THEN PRINT "Found at p
osition ";mid ELSE PRINT "Not found"
  180 END
```

Program II

```
   10 REM Program III
   20 REM Hash Searching Demo
   30 REM John Tissandier
   40 REM (c) The Micro User
   50 MODE7
   60 PROCinit
   70 REPEAT
   80 PROCheading("MENU")
   90 PRINT''"A...Add item"
  100 PRINT'"F...Find item"
  110 PRINT'"Q...Quit"
  120 PRINT'"T...Table"
  130 REPEAT
  140 *FX21,0
  150 choice$=CHR$(GET AND &5F)
  160 UNTIL INSTR("AFQT",choice$)
  170 IF choice$="A" THEN PROCadd
  180 IF choice$="F" THEN PROCfind
  190 IF choice$="T" THEN PROCtable
  200 UNTIL choice$="Q"
  210 MODE7
  220 *FX200,0
  230 END
  240 DEF PROCinit
  250 LOCAL ans$
  260 *FX200,1
  270 num%=0
  280 rem$="Press RETURN for MENU"
  290 PROCheading("HASH DEMO")
  300 INPUT''"Maximum number of items
? " max%
  310 IF max%<1 THEN END
  320 size%=max%/100*130
  330 IF size%=max% THEN size%=size%+1
  340 DIM table$(size%-1)
  350 PRINT'"Dummy data? ";
  360 ans$=GET$:PRINT ans$
  370 VDU23,1,0;0;0;0;
  380 IF INSTR("Yy",ans$) THEN PROCdu
mmydata
  390 ENDPROC
  400 DEF PROCheading(h$)
  410 LOCAL x%,y%
  420 VDU26,12
  430 x%=14-(LEN(h$) DIV 2)
  440 FOR y%=1 TO 2
  450 PRINT TAB(x%,y%);CHR$(141);CHR$
(132);CHR$(157);CHR$(131);SPC(1);h$;S
PC(3);CHR$(156)
  460 NEXT
  470 ENDPROC
  480 DEF PROCdummydata
  490 LOCAL c%,len%,pause
  500 PRINT TAB(0,10);CHR$(129);"Numb
er of items = "
  510 REPEAT
  520 item$=""
  530 len%=RND(7)
  540 FOR c%=1 TO len%
  550 item$=item$+CHR$(64+RND(26))
  560 NEXT
  570 PROChash(item$)
  580 IF found=FALSE THEN table$(pos%
)=item$:num%=num%+1:PRINT TAB(19,10);
num%
  590 UNTIL num%=max%
  600 pause=INKEY(100)
  610 ENDPROC
  620 DEF PROChash(i$)
  630 LOCAL c%,e$,len%
  640 found=FALSE
  650 code$=""
  660 len%=LEN(i$)
  670 IF len%>4 THEN len%=4
  680 FOR c%=1 TO len%
  690 code$=code$+STR$(ABS(ASC(MID$(i
$,c%,1))-64))
  700 NEXT
  710 hash%=VAL(code$) MOD size%
  720 pos%=hash%
  730 steps%=0
  740 REPEAT
  750 steps%=steps%+1
  760 e$=table$(pos%)
  770 IF e$=i$ THEN found=TRUE ELSE I
F e$<>"" THEN pos%=(pos%+1) MOD size%
  780 UNTIL found OR e$=""
  790 ENDPROC
  800 DEF PROCadd
  810 PROCheading("ADD ITEM")
  820 PROCfooting(rem$)
  830 REPEAT
  840 IF num%=max% THEN PROCmessage("
Table full"):UNTIL TRUE:ENDPROC
  850 item$=FNinput
  860 IF item$="" THEN UNTIL TRUE:END
PROC
  870 PROChash(item$)
  880 IF found THEN VDU7:PRINT'CHR$(1
31);"Already in table" ELSE table$(po
s%)=item$:num%=num%+1:PROCvalues
  890 PRINT:PRINT
  900 UNTIL FALSE
  910 ENDPROC
  920 DEF PROCfooting(f$)
  930 LOCAL x%
  940 x%=15-(LEN(f$) DIV 2)
  950 PRINT TAB(x%,24);CHR$(132);CHR$
(157);CHR$(131);SPC(1);f$;SPC(3);CHR$
(156);
  960 VDU28,0,21,39,5
  970 ENDPROC
  980 DEF PROCmessage(m$)
  990 IF m$<>"" THEN VDU7:PRINT CHR$(
131);m$
 1000 *FX21,0
 1010 REPEAT UNTIL GET=13
 1020 ENDPROC
 1030 DEF FNinput
 1040 LOCAL i$
 1050 VDU23,1,1;0;0;0;
 1060 INPUT "Which item? " i$
 1070 VDU23,1,0;0;0;0;
 1080 =LEFT$(i$,7)
 1090 DEF PROCvalues
 1100 PRINT'CHR$(129);"Code = ";code$
 1110 PRINT CHR$(129);"Hash value = "
;code$;" MOD ";size%;" = ";hash%
 1120 PRINT CHR$(129);"Position in ta
ble = ";pos%
 1130 PRINT CHR$(129);"Number of step
s = ";steps%
 1140 ENDPROC
 1150 DEF PROCfind
 1160 LOCAL temp%
 1170 PROCheading("FIND ITEM")
 1180 PROCfooting(rem$)
 1190 IF num%=0 THEN PROCmessage("Tab
le empty"):ENDPROC
 1200 REPEAT
 1210 item$=FNinput
 1220 IF item$="" THEN UNTIL TRUE:END
PROC
 1230 temp%=@%:@%=&2020A
 1240 TIME=0
 1250 PROChash(item$)
 1260 IF found THEN PRINT'CHR$(131);"
Found" ELSE PRINT'CHR$(131);"Not foun
d"
 1270 PRINT'CHR$(129);"Time = ";TIME/
100;" seconds"
 1280 @%=temp%
 1290 PRINT CHR$(129);"Number of step
s = ";steps%
 1300 PRINT:PRINT
 1310 UNTIL FALSE
 1320 ENDPROC
 1330 DEF PROCtable
 1340 LOCAL i%
 1350 PROCheading("CHECK TABLE")
 1360 IF size%>17 THEN VDU14:PROCfoot
ing("Press SHIFT to continue") ELSE P
ROCfooting(rem$)
 1370 FOR i%=0 TO size%-1
 1380 PRINT i%;SPC(3);table$(i%);
 1390 IF i%<size%-1 THEN PRINT
 1400 NEXT
 1410 VDU15,26
 1420 PROCfooting(rem$)
 1430 PROCmessage("")
 1440 ENDPROC
```

Program III

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request for the maximum number of items to go in the table. In practice these items could be the names of people, the titles of books or anything you like.

Let's keep it short and sweet to start with. Enter 10 and press Return. Next you are asked if you want any dummy data. Not yet – so press any key (within reason) apart from Y.

You should now see the menu. The options are Add item, Find item, Quit and Table. The first three options are straightforward. The last is there to aid our understanding, so hit T.

```
0
1
2
3
4
5
6
7
8
9
10
11
12
```

Figure I: Empty hash table

You should see revealed our hash table in all its emptiness (refer to Figure I). But look carefully. At the beginning of the program we specified a maximum of 10 items and yet we seem to have space for 13 (the table only goes up to 12, but don't forget location zero). This is the first clue as to how it all works, and perhaps your first inkling that there is a price to pay.

Hash searching carries the penalty that the array used to hold the table must be bigger than actually required by the data – 20 to 30 per cent bigger in fact. What, you may be asking, goes into the remainder of the array? The answer is empty spaces, but as we shall see later, these spaces have an important role to play.

Press Return for the menu and choose the *Add item* option. In response to "Which item?" enter the capital letter A and press Return. The screen should now display the information shown in Figure II.

```
code = 1
Hash value = 1 MOD 13 = 1
Position in table = 1
Number of steps = 1
```

Figure II: Information displayed after A is added to hash table

The values displayed are for the purpose of finding out what is going on. So what do they signify?

First let's pause for a moment to consider the requirements of an ideal search method. Ideally we would want some means of deriving a unique value from an item to be placed in the array holding a table of data.

If the value was within the range of the subscripts of the array it could then be used to determine which element of the array was occupied by that particular item.

When subsequently a search was made for that item the same value could be re-calculated, so that you could jump directly to the element specified without having to mess about checking the rest of the array.

This is precisely what a hash search is all about. The unique value is known as a hash value, and a function to derive it is variously known as a hash or access or randomising function.

It must be used before placing an item in an array and subsequently can be used to recover it.

It should be noted, however, that in practice hash values are not necessarily unique. The strategy to cope with items having the same hash value is described later.

In the program, PROChash achieves this in two stages. Firstly, it begins by working out a numerical code based on the characters making up an item. I have used a system where A=1, B=2, C=3 and so on. This explains Code=1 (see Figure II), as A is the first letter of the alphabet.

Secondly PROChash ensures that this code is within the range of our table. It does this by applying the modulus function that is MOD n, where n is the size of the table. In the example n=13, so whatever the value of the code the final result (the hash value) will always be between 0 and 12. So for item A the hash value is the remainder after dividing 1 by 13, which of course is 1.

The next line (see Figure II) says that item A is indeed in position 1 of the table. Why there should be the need for this distinction between the actual position and the calculated hash value will become clear in a moment, as will the significance of the number of steps.

We can now check the table. Return to the menu and press T. The table should appear as in Figure III.

Let's try another entry. Return to the menu, choose option Add item and enter ABC. The code is 123. Note that the individual codes for the characters are joined together rather than added together. The reason for this is that it creates a larger spread of values. According to the rest of the information, the item should be in position 6. Again, we can check the table, which is shown in Figure IV.

```
0
1 A
2
3
4
5
6
7
8
9
10
11
12
```

Figure III: Hash table after A is added

Next we can check the searching facility. Return to the menu and choose Find item. Enter A and press Return. PROCfind applies the same hash function just used and therefore is able to go straight to location 1.

It checks that it is indeed A there and the message Found should appear on the screen, together with the time taken (0.04 seconds on my micro). The number of steps required for the search was 1.

```
0
1 A
2
3
4
5
6 ABC
7
8
9
10
11
12
```

Figure IV: Hash table after ABC is added

Let's try searching for an item not in the table. Type L and press Return. The program should respond with Not found. The interesting thing to note here is that the number of steps required was 1. L is the twelfth letter in the alphabet, so had it been in the table it would have occupied location 12.

Because of the hash function the

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program went straight there, found the location was empty and concluded that the item did not exist in the table. To check all the other locations was unnecessary.

We'll try one more thing before I leave you to your own explorations. Choose menu option Add item and enter the name JIM. The code is 10913 and MOD 13 gives 6.

We would seem to have a problem. Isn't location 6 where the program put ABC? The problem is solved by searching forward from the hashed position until the first empty location is found. Hence our entry ends up in location 7 (see Figure V), but notice that the number of steps required was two.

This "collision" situation, where a number of items want to occupy the same location, is an inevitable aspect of hashing which we must accept. The search procedure takes this into account by first jumping to the hashed position in the table and then checking what is there.

If it's not the item being searched for it performs a forward linear search from that position until either the item is found or an empty location is reached.

0	
1	A
2	
3	
4	
5	
6	ABC
7	JIM
8	
9	
10	
11	
12	

Figure V: Hash table after JIM added

In the latter case it concludes that the item is not present in the table because, remember, the rule for storing an item is "put it in the first available forward location".

Now we can see the purpose of those empty spaces. Although when a collision occurs the program goes off on a linear search for a free slot, this will be much shorter than a conventional linear search. If an item is not in the table this will be known as soon as the first empty location is reached.

0	BILL
1	A
2	
3	
4	
5	
6	ABC
7	JIM
8	
9	
10	
11	
12	L

Figure VI: Wraparound. BILL has hash value 12, but slot 12 occupied, so ends up in slot 0.

By the way, a hash table is circular. It will wraparound when the end of the table is reached. For example, suppose that the table contained the letter L in slot 12 and we wished to add BILL. This also has hash value 12, so it would end up in the next available space which is slot 0 (see Figure VI).

There is a trade-off between fast search times and memory usage. We have to compromise between a big increase in the size of the array, which because of the good chance of finding an empty location increases efficiency, and the limited memory available for the program in our machines.

Experts recommend an increase of 20 to 30 per cent. Another way of seeing it is to say that the table must not get more than about three-quarters full.

It would be very nice if the empty locations were distributed evenly throughout the table. Unfortunately this is unlikely to happen. You can observe what happens with bigger tables by re-running the program several times for 100 items and answering Y to the request for dummy data.

Choose option T to check what is going on in the table. You will probably see that bunching takes place and consequently when searching for some items the number of steps required will rise. There is no easy solution to this problem at an introductory level.

The main thing is to choose a hash function that gives a good spread of values across the table. Note that apart from this criterion the actual values are quite arbitrary. I could have chosen any number of different systems for working out a value for each word.

Incidentally, Program III only checks the first four characters of a word. This is to accommodate the biggest possible value in a single integer. However if you had a lot of items such as FRED1, FRED2, FRED3, and so on it would make more sense to include the last character in the reckoning.

Ideally a hash function should be designed with the distribution of values of a particular set of data in mind.

Note that no Delete item option is included in the menu. Deleting an item from a hash table can have severe consequences. This is because of the way the search works by looking for an empty space. The normal way of deleting, by making an item equal to a null string, would stop the search at this new empty location. Hence some items placed beyond their hashed position might never be reached.

I hope by now you have some understanding of the concept of hashing. You may like to explore search times for large tables. The length of items has been limited to seven characters for this reason. For 2,000 items disc users will need to lower PAGE to &1100 and reload the program to avoid the "No room" error.

Program V is a modified version of Program III with all the tutorial aspects deleted. It applies the hashing technique to a file held on disc.

The PTR file-pointer, which can move to any point within a file, is set equal to the value of the hash function. This means that a search will not begin at the start of a file, but go straight to that point in the file where the search item is expected according to its hash value.

To ring the changes the items being stored are integer numbers. For 16,000 integers stored on a disc a linear search to discover that an item was not in the file would take about 12 minutes. On average Program V copes with this situation in seven tenths of a second, over a thousand times faster.

Basic I owners should change lines 330 and 360 to:

```
330 chan%=OPENIN("TABLE")
360 chan%=OPENIN("INFO")
```

Before you use Program V you will need to create the file called TABLE by running Program IV. The maximum number of integers in the file is determined by the value of *max%* in line 60. Change this as required.

Another file INFO is created to store the file specifications – the maximum number of items allowed, the size of the

```
   10 REM Program V
   20 REM Hash Searching Demo
   30 REM on Disc File
   40 REM John Tissandier
   50 REM (c) The Micro User
   60 ON ERROR choice$="":GOTO 210
   70 MODE7
   80 PROCinit
   90 REPEAT
  100 PROCheading("MENU")
  110 PRINT''"A...Add item"
  120 PRINT'"F...Find item"
  130 PRINT'"Q...Quit"
  140 REPEAT
  150 *FX21,0
  160 choice$=CHR$(GET AND &5F)
  170 UNTIL INSTR("AFQ",choice$)
  180 IF choice$="A" THEN PROCadd
  190 IF choice$="F" THEN PROCfind
  200 UNTIL choice$="Q"
  210 CLOSE#0
  220 IF ERR<>222 THEN PROCinfo("writ
e")
  230 MODE7
  240 IF choice$<>"Q" THEN VDU7:REPOR
T:PRINT " at line ";ERL
  250 END
  260 DEF PROCinit
  270 VDU23,1,0;0;0;0;
  280 PROCinfo("read")
  290 PROCheading(title$)
  300 PRINT''"Number of items = ";num
%
  310 PRINT'"Maximum number = ";max%
  320 PROCfooting:PROCmessage("")
  330 chan%=OPENUP("TABLE")
  340 ENDPROC
  350 DEF PROCinfo(o$)
  360 chan%=OPENUP("INFO")
  370 IF o$="read" THEN INPUT# chan%,
num%,max%,size%,reclen%,title$ ELSE P
RINT# chan%,num%
  380 CLOSE# chan%
  390 ENDPROC
  400 DEF PROCheading(h$)
  410 LOCAL x%,y%
  420 VDU26,12
  430 x%=14-(LEN(h$) DIV 2)
  440 FOR y%=1 TO 2
  450 PRINT TAB(x%,y%);CHR$(141);CHR$
(132);CHR$(157);CHR$(131);SPC(1);h$;S
PC(3);CHR$(156)
  460 NEXT
  470 ENDPROC
  480 DEF PROCfooting
  490 PRINT TAB(5,24);CHR$(132);CHR$(
157);CHR$(131);SPC(1);"Press RETURN f
or MENU";SPC(3);CHR$(156);
  500 VDU28,0,21,39,5
  510 ENDPROC
  520 DEF PROCmessage(m$)
  530 IF m$<>"" THEN VDU7:PRINT CHR$(
131);m$
  540 *FX21,0
  550 REPEAT UNTIL GET=13
  560 ENDPROC
  570 DEF PROCadd
  580 PROCheading("ADD ITEM")
  590 PROCfooting
  600 REPEAT
  610 IF num%=max% THEN PROCmessage("
Table full"):UNTIL TRUE:ENDPROC
  620 item%=FNinput
  630 IF item%=0 THEN UNTIL TRUE:ENDP
ROC
  640 PROChash(item%)
  650 IF found THEN VDU7:PRINT'CHR$(1
31);"Already in table" ELSE PRINT# ch
an%,item%:num%=num%+1
  660 PRINT
  670 UNTIL FALSE
  680 ENDPROC
  690 DEF FNinput
  700 LOCAL i%
  710 VDU23,1,1;0;0;0;
  720 INPUT "Which item? " i%
  730 VDU23,1,0;0;0;0;
  740 =i%
  750 DEF PROChash(i%)
  760 LOCAL e%
  770 found=FALSE
  780 h%=ABS(i% MOD size%)
  790 REPEAT
  800 PTR# chan%=h%*reclen%
  810 INPUT# chan%,e%
  820 IF e%=i% THEN found=TRUE ELSE I
F e%<>0 THEN h%=(h%+1) MOD size%
  830 UNTIL found OR e%=0
  840 PTR# chan%=h%*reclen%
  850 ENDPROC
  860 DEF PROCfind
  870 PROCheading("FIND ITEM")
  880 PROCfooting
  890 IF num%=0 THEN PROCmessage("Tab
le empty"):ENDPROC
  900 REPEAT
  910 item%=FNinput
  920 IF item%=0 THEN UNTIL TRUE:ENDP
ROC
  930 PROChash(item%)
  940 IF found THEN PRINT'CHR$(131);"
Found" ELSE PRINT'CHR$(131);"Not foun
d"
  950 PRINT
  960 UNTIL FALSE
  970 ENDPROC
```

Program V

```
   10 REM Program IV
   20 REM Initialise files
   30 REM John Tissandier
   40 REM (c) The Micro User
   50 num%=0
   60 max%=1000
   70 size%=max%/4*5
   80 reclen%=5
   90 title$="TABLE OF INTEGERS"
  100 chan%=OPENOUT("INFO")
  110 PRINT# chan%,num%,max%,size%,re
clen%,title$
  120 CLOSE# chan%
  130 chan%=OPENOUT("TABLE")
  140 FOR i%=0 TO (size%-1)*reclen% S
TEP reclen%
  150 PTR# chan%=i%
  160 PRINT# chan%,num%
  170 NEXT
  180 CLOSE# chan%
  190 END
```

Program IV

array (25 per cent increase), the record length (five bytes for an integer), the title and also the current number of integers. The latter is updated when you quit Program V, so make sure you leave it via the official menu option. (If an error occurs the updating will occur automatically.)

As they stand the programs are rather unrealistic in that it is unlikely we would be interested in a single list of words or numbers. In a more realistic example we would have a "search key" and a number of related fields, such as key=name; fields: age, address, phone number.

If you have managed to keep reading this far you shouldn't find it too hard to modify Program III to set up parallel arrays or a multi-dimensional array to store this extra data. Similarly, extra fields can be added to Programs IV and V and their contents displayed when a search is successful.

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Just how loopy can you get?

BEGIN HERE
Part 8

By PETE BIBBY

LAST time we extended our exploration of FOR ... NEXT loops. We saw how two loops could be nested, one inside the other and how the loop control variable of the outer loop could be used to limit the workings of the inner loop.

We also discovered how control variables can be used inside loops, and showed this by producing triangles of asterisks. We'll be continuing now with FOR ... NEXT loops and seeing what happens when we get our control variables in a twist. We'll also be sticking to asterisks to illustrate the main points.

Last month I challenged you to produce the two triangles of asterisks shown in Figures I and II.

If you'd wanted you could have done it all with PRINT and TAB statements, but it would have been a long job. However, since the article was about FOR ... NEXT loops I hope you arrived at a solution that looks something like Program I.

This produces one of the required triangles. A quick glance shows that it uses a pair of nested FOR ... NEXT loops in the same way we used them last month. The loop control variables *asterisk* and *row* should be familiar as well. What's different is line 50.

As you can see it's a PRINT statement, the TAB determining exactly where the asterisk will be positioned on the screen.

```
    *
   **
  ***
 ****
*****
```

Figure I

```
*****
 ****
  ***
   **
    *
```

Figure II

Each time the micro obeys line 50 it places an asterisk on the screen at the point whose X and Y coordinates are determined by the result of the expression:

```
5-asterisk, 5+row
```

The values of *row* and *asterisk* will vary in just the same way as in the examples from last month. The loops themselves are the same, only this core statement differs.

What's different is the way we use these values of *asterisk* and *row* to position the asterisk. We don't just PRINT at the X and Y coordinates determined by *row* and *asterisk*, we use these values in an expression whose result gives use the coordinates of the positions we want.

Don't be put off. Like most things in programming, it's easier than it sounds. The X position of an asterisk – in character spaces from the left edge of the screen – is given by the result of:

```
5-asterisk
```

The Y position – rows down from the top of the screen – is given by:

```
5+row
```

By the time the nested loops have untangled themselves, this results in the desired triangle.

If you can't quite follow the maths work through the program with pencil and paper. Just figure out the values of the above expressions for each combination of values of *asterisk* and *row*.

If you think about it you'll see that *row* varies in value from 1 to 5, so the Y coordinates will range from 6 to 10. Similarly as *asterisk* ranges from 1 to whatever value of *row* is in force at that stage of the outer loop, so the X coordinates will range from 4 to 0.

The first time round the loop *row* is 1. As *asterisk* varies from 1 to *row*, this means that the inner loop only cycles once. One solitary asterisk is printed, at the screen position with coordinates (4,6).

Next time round *row* is 2, with the result that *asterisk* now ranges from 1 to 2. The inner loop accordingly cycles twice and asterisks are printed at (4,7) and (3,7).

Carrying on like this results in the whole triangle. By successively reducing the X coordinate while increasing the Y coordinate we've got our triangle of asterisks.

If figuring it out with pencil and paper

→

```
10 REM PROGRAM I
20 CLS
30 FOR row=1 TO 5
40 FOR asterisk=1 TO row
50 PRINT TAB(5-asterisk,5+row)"*"
60 NEXT asterisk
70 PRINT
80 NEXT row
```

Program I

```
 10 REM PROGRAM II
 20 CLS
 30 FOR row=1 TO 5
 40 FOR asterisk=1 TO row
 50 PRINT TAB(10-asterisk,10-row)"*
"
 60 NEXT asterisk
 70 PRINT
 80 NEXT row
 90 VDU 30
```

Program II

From Page 87

seems too much like hard work try changing line 50 to something like:

```
50 PRINT "xpos ";(5-asterisk) " ypos
";(5+row)
```

and your micro will do the work for you, printing out all the coordinates.

After all that you should be able to figure out what's happening in Program II, which produces the second of our problem triangles.

It's the familiar structure of two nested loops with *row* and *asterisk* going through their usual paces. The result is a different triangle and again the reason is found in line 50.

It's here that the X and Y coordinates positioning the asterisks are worked out. The values of *row* and *asterisk* vary just as before, but now the expression in line 50 is different, resulting in different X and Y coordinates. The expression is:

```
(10-asterisk,10-row)
```

There's no particular magic in the value 10. I just used it so that everything appeared on the screen. Try 7, 8 or 9 if you want.

The significant thing is that *row* is now subtracted from whatever number you choose, whereas before it was added. This means that as *row* increases and the rows have more asterisks in them, so the Y coordinate decreases. The result is that each successive row is one space higher up the screen. Again work it out with pencil and paper or add a line like:

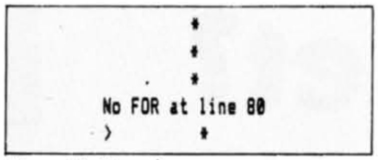
```
50 PRINT "xpos ";(10-asterisk) " ypos
";(10-row)
```

and you'll soon see how it works.

The main point to grasp is that while the loops themselves have more or less remained the same it's the way the changing values of the loop control variables are used inside these loops that brings about the differing results.

And don't worry about the VDU 30. All it does is home the cursor to the top left of the screen. It's just there to keep things tidy. Leave it out and see what happens.

Program III isn't all that much different from Program II yet the results, shown in Figure III, aren't what you might expect. Can you figure out what's gone wrong?



```
                    *

                    *

               .    *

      No FOR at line 80
      >              *
```

Figure III: Wrong!

It's happened because I've mixed up the control variables that I've used with the NEXTs. It should be *asterisk* in line 60 and *row* in line 80. The micro tries its best, but there's no remedy for human stupidity.

When the program starts the micro comes to the first FOR and sees that there's a loop with control variable *row*. Then, on reaching the second FOR, it realises that there's another loop with control variable *asterisk*.

However the next NEXT – if you see what I mean – is tagged with a *row* so the micro dutifully goes back to line 30 and obeys the loop again. In all it goes round five times, each time printing a solitary asterisk. It then drops out of the *row* loop, proceeds to line 80 and finds another NEXT tagged with *asterisk*.

The trouble is that the way that Basic works has meant that the first complete FOR ... NEXT loop has overwritten all traces of the second loop. The micro can't find any FOR to correspond with this latest NEXT and tells you so with the error message.

The moral is don't mix up your loops. For nested loops to work, each loop has to be contained entirely within the others. You can think of it as a Russian doll – one loop has to be contained completely within the others. Any overlap and the program may work after a fashion but not as you intended. Figure IV illustrate the point.

So far we've only had pairs of nested loops, and the more devious readers may be wondering if it's posible to have more than two nested loops. The answer is that you can, as Program IV shows.

```
10 REM PROGRAM IV
20 CLS
30 FOR outer=1 TO 10
40 FOR middle=1 TO 10
50 FOR inner=1 TO 10
60 PRINT "*";
70 NEXT inner
80 NEXT middle
90 NEXT outer
```

Program IV

It's not a very exciting program, it just prints 10000 (10*10*10) asterisks on the screen. However, you should be able to see from its structure that there are three loops, each one contained wholly inside the other. With this new dimension we'll take our leave of FOR ... NEXT loops for the time being.

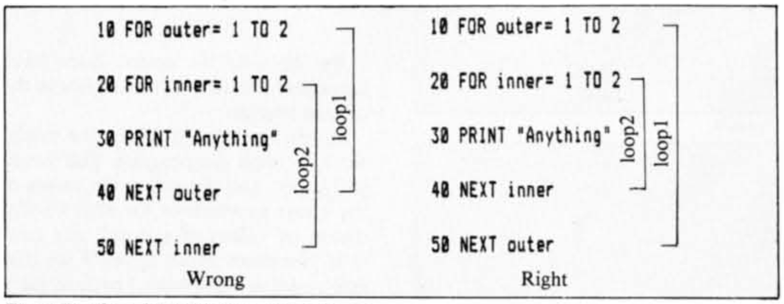
We've explored them pretty thoroughly and if you've understood the last few articles, you've got the makings of a competent programmer. There is one thing that we haven't mentioned though.

How many loops can be nested inside one another? The most we've had is three. I won't tell you the answer – you can find it out as you explore FOR ... NEXT loops with your own programs. I'll give you a hint though: Try expanding Program IV one loop at a time.

- *That's it for this month. Next time we'll be doing something completely different.*

```
10 REM PROGRAM III
20 CLS
30 FOR row=1 TO 5
40 FOR asterisk=1 TO row
50 PRINT TAB(10-asterisk,10-row)"*
"
60 NEXT row
70 PRINT
80 NEXT asterisk
90 VDU 30
```

Program III



```
10 FOR outer= 1 TO 2
20 FOR inner= 1 TO 2
30 PRINT "Anything"
40 NEXT outer
50 NEXT inner
```

Wrong

```
10 FOR outer= 1 TO 2
20 FOR inner= 1 TO 2
30 PRINT "Anything"
40 NEXT inner
50 NEXT outer
```

Right

Figure IV: The rights and wrongs of nested loops

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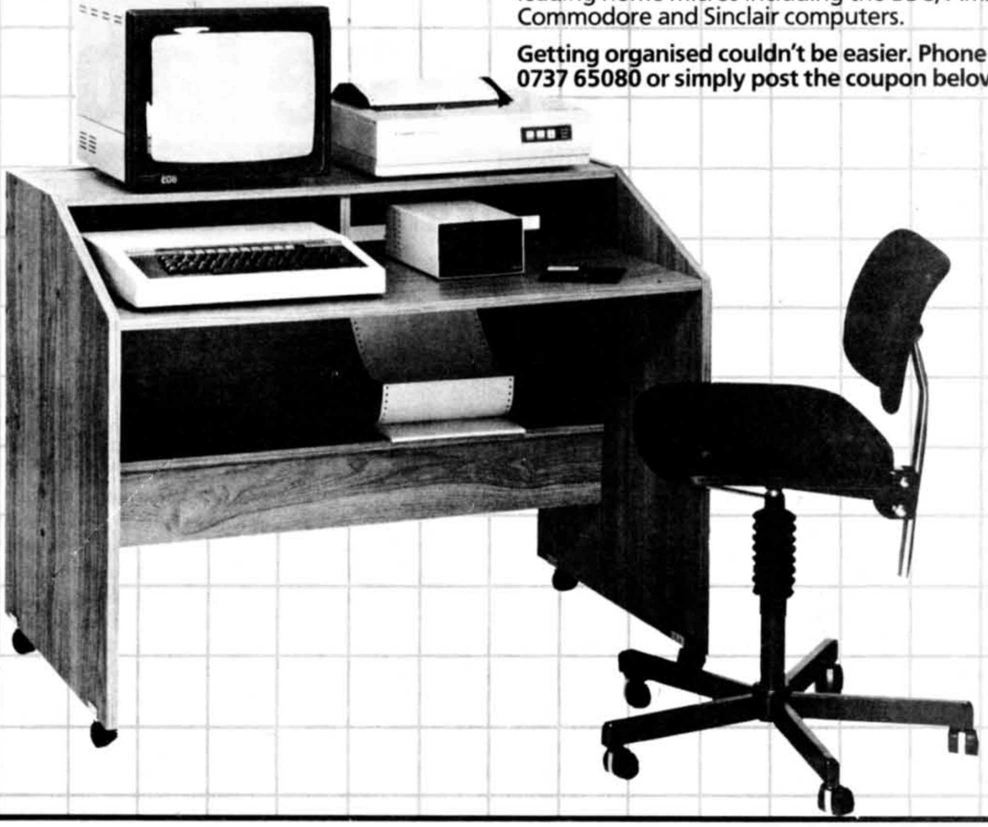

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Add-on RAM is destined for the lab

ROBERT ELSELL reviews the Sacram RAM unit and finds a well made product for scientific applications

Product: Sacram
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SACRAM – the Seawell Automatic Controls add-on RAM unit – comes in a matching BBC Micro-beige half-height disc drive case. Its own power supply and mains lead are provided as well as a fairly short cable to connect the unit to the 1 MHz bus. Besides the unit itself you get an eprom and a slim but lucid instruction booklet.

Paged memory is in style at the moment. Sideways ROMs in the BBC Micro have always demonstrated to us how the same addresses – as far as the 6502 is concerned – can hold different programs or data.

Shadow memory as in the BBC+ and the Master, and the add-on boards from Watford and Aires, allow us to page screen memory. Sacram in turn allows us to page a part of the operating system memory – by coincidence just one page.

Two pages of the operating system memory – remember the OS is in ROM – are switched by means of links on the main circuit board into RAM. Thus we can read and write to these locations.

One page called Fred, from &FC00 to &FCFF, is allocated by Acorn for memory mapped input/output devices. Various bytes are allocated to test equipment, hard discs and so on – you can find details in Chapter 28 of the Advanced User Guide.

The other page &FD is called Jim and was provided to allow the addition of an extra 64k of RAM. Although this RAM can be used for holding parts of a program, as discussed later, it's not very easy to do.

The original specification set out by Acorn was for a register in Fred to record which page of Jim was being accessed. This led to the size of 64k of accessible memory. Remember when the specification was written RAM chips were expensive.

However to overcome this limitation now that memory is so much cheaper the Sacram utilises the idea of blocks of 64k, with reference to each block being held in a second register in Fred. This second register is one set aside for user purposes. The Sacram unit can in fact be expanded to 512k.

The manual provides brief examples of Basic and machine code routines for accessing the additional memory, and it is a relatively trivial task to implement simple data storage.

Thus a data logging task, a favourite job for the micro in the laboratory, can be implemented by loops progressively incrementing the address to store values.

Although accessing memory through the 1MHz bus may be 20 times slower than accessing memory directly, it is still very much faster than saving to a disc file. It also means that there is a lot of the normal RAM available for the data capture program or for preprocessing the signal once it has been obtained.

A large part of the manual deals with commands for the ROM which accompanies the unit. This need not be present to use Sacram – it merely provides four utilities to speed up data transfer between the unit and disc, or the unit and normal RAM. The commands are:

***DISKRAM** [option] [filename] [destination address]

***RAMDISK** [option] [filename] [source address] [number of bytes to transfer]

***BEEBRAM** [option] [source address] [destination address]]number of bytes to transfer]

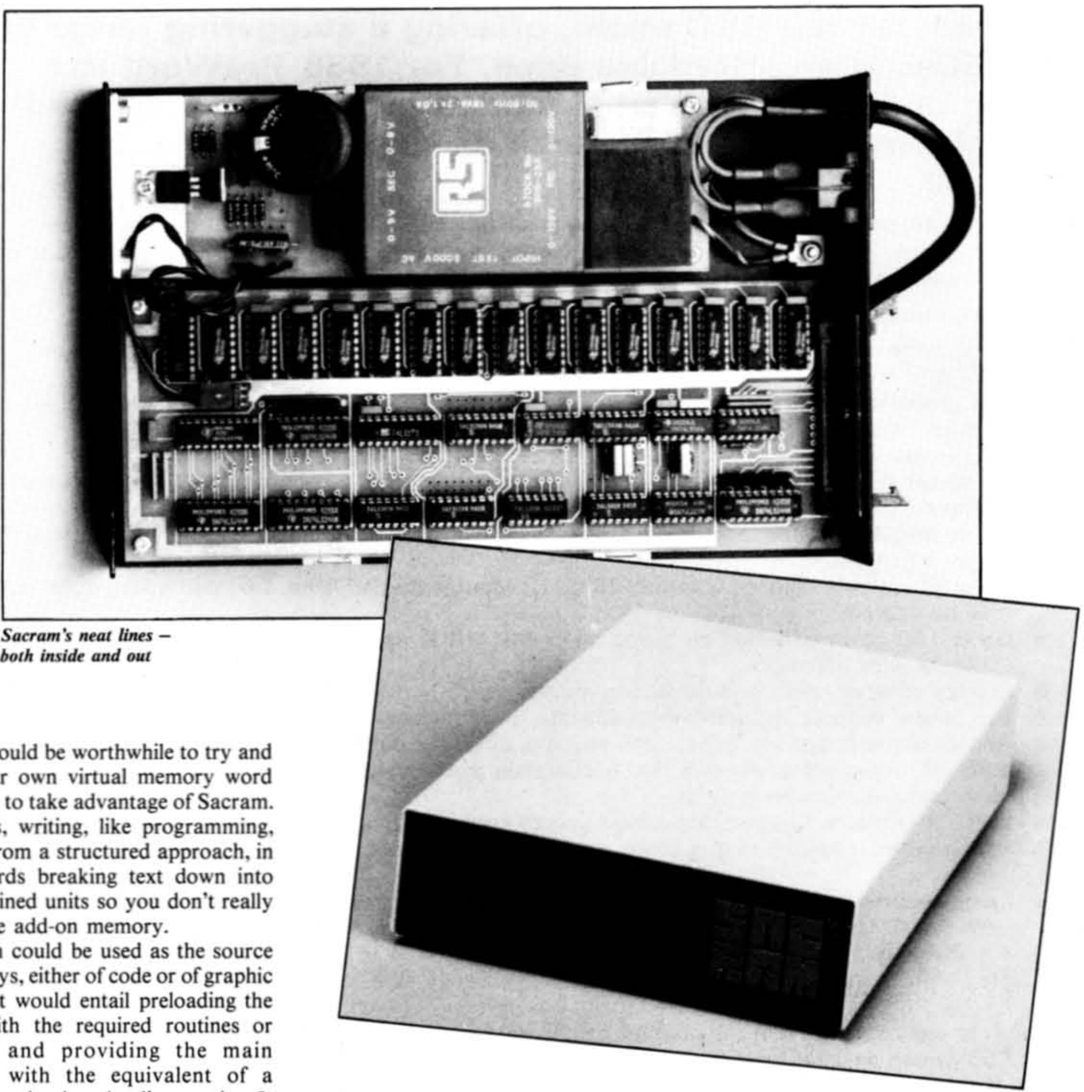
***RAMBEEB** [option] [option] [destination address] [source address] [number of bytes to transfer]

The option parameter allows a choice of one from four. It will permit a combination of legal OS calls versus higher speed transfers, with choice about how the address parameters are to be provided.

My inclination would be to leave the ROM out, as when it was fitted to my machine the Acorn DNFS ROM misbehaved with disconcerting results – it didn't ask those Yes/No questions before BACKUP or DESTROY.

The front page of the manual suggests that typical applications of Sacram are word processing, file manipulation, graphics storage and data processing. While it is undoubtedly true that you can achieve such applications, you are given no hints on how best to undertake them.

The only software provided is the ROM. It is difficult to see how you might interface Sacram with a commercial word processor like View, Wordwise or Mini Office II. I don't



Sacram's neat lines – both inside and out

think it would be worthwhile to try and write your own virtual memory word processor to take advantage of Sacram.

Besides, writing, like programming, benefits from a structured approach, in other words breaking text down into self-contained units so you don't really need large add-on memory.

Sacram could be used as the source for overlays, either of code or of graphic screens. It would entail preloading the device with the required routines or screens, and providing the main program with the equivalent of a directory and a downloading routine. It would be fairly messy and anyway it is what a DFS is for. It is unlikely that someone without a disc drive would buy the Sacram instead.

There are two similar devices on the market. The Opus Challenger, reviewed in the February 1986 issue, contains both a disc drive and a RAM module which may be accessed as if it were an extra drive.

The second is the 64k RAM produced by PMS, reviewed in January 1986, which comes with considerably more software, including configuration as an additional disc drive.

It is also supplied with battery back-up, so it can be moved from one machine to another. An extended unit addressable from the Z80 second processor is forecast.

In terms of buying additional memory Sacram is considerably more expensive than either shadow RAM boards, or sideways RAM, while a Solidisk board configured as a silicon disc makes an ultra fast mass storage device.

For ease of use and multiplicity of uses a 6502 second processor will provide extra memory, but at about twice the cost per byte. I believe the Sacram would have sold like hot cakes if it had been available soon after the BBC Micro was launched, but for most users it has now been superseded.

The Sacram is a well made product, apparently built strictly to the Acorn guidelines for peripherals that attach to the 1 MHz bus. It works, and as I need large scale and fairly rapid data capture it is ideal for me.

However I feel its appeal outside a restricted laboratory setting must be small. The difficulty of getting it to do anything – never mind finding a need for it – combined with the fairly severe price suggests it will have a very limited market open to it.

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Make the keyboard an offer it can't refuse

JOE PRITCHARD has an elegant routine aimed at the educational programmer for forcing the keyboard into upper case for input

AS an active educational programmer, I'm always on the look out for neat ways of vetting inputs to programs. In particular I was interested in a way of forcing the keyboard into upper case input for characters.

It occurred to me that there was a method to ensure this, using one of the many vectors provided by the BBC Micro's operating system. In this article I will show how this can be done.

Put simply, vectors are locations in the memory of the computer which contain the address of special routines. Vectors are frequently in RAM, so that changes in operating system configuration can be hidden by changing the contents of the vector to hold the new address of a user routine.

Provided you access all OS routines via the appropriate vector, then alterations, of which there have been a few on the BBC Micro, will have little impact on your programs.

Page &2 on the BBC Micro contains many vectors, and by changing the addresses held in them we can alter the behaviour of the operating system by pointing the vector to a piece of our own code.

That is precisely what this program does. The vector accessed by the BBC Micro whenever the keyboard is read is intercepted and pointed to our own code, which simply forces the Caps Lock on or off before every keyboard operation. Once this is done we jump to the address that is normally in the vector and the OS carries on as normal.

So down to details and this program. The vector is at address &228 and &229, and the first job for any program altering vectors is to store the usual contents in a variable for later use. This is done in line 90.

Lines 280 and 290 change the contents of the vector to point to our own program, which is very simple in operation.

Lines 150 to 180 preserve the processor registers, lines 190 to 210 carry out an Osbyte call to force the Caps Lock on and lines 220 to 250 restore the registers.

Line 260 jumps to the address usually stored in the keyboard vector. The same Osbyte call, but with a parameter of 48 in X, can be used to force the keyboard into lower case. In this case (excuse the pun) upper case letters will be available only when Shift is held down. In both examples it will be impossible to force Shift Lock on.

To disable this function the keyboard vector can be restored to its original value, or it can be disabled by pressing the Break key.

This routine will work with some commercially written software providing that the program doesn't alter the vector back or use page &A. I hope that this routine will be useful to anyone involved in educational programming, or other applications where input validation is needed.

```
   10 REM Ensuring upper case input
   20 REM of text into programs.
   30 REM By Joe Pritchard
   40 REM (c) The Micro User
   50 PROCassemble
   60 END
   70 DEFPROCassemble
   80 keyv=&228:keyvhi=&229
   90 oldadd=?keyv+256*?keyvhi
  100 osbyte=&FFF4
  110 FOR pass=0 TO 2 STEP 2
  120 P%=&0A00
  130 [OPT pass
  140 .uppercase
  150 PHP                       \ prese
rve processor registers
  160 PHA
```

```
  170 TXA:PHA
  180 TYA:PHA
  190 LDX #32                   \ or LD
X #48 to turn lock off
  200 LDA #202
  210 JSR osbyte
  220 PLA:TAY
  230 PLA:TAX
  240 PLA
  250 PLP                       \ resto
re registers
  260 JMP oldadd
  270 ]:NEXT
  280 ?&228=uppercase MOD 256
  290 ?&229=uppercase DIV 256
  300 ENDPROC
```

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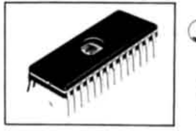

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```
   10REM FRUIT WORM By C.Dunkley
   20REM (c) The Micro User
   30REM ++++++++++++++++++
   40ON ERROR MODE7:REPORT:PRINT" at
line ";ERL:END
   50IF PAGE>&E00 THEN 6070
   60MODE5
   70PROCinitialise
   80REPEAT
   90PROCtitles
  100REPEAT
  110PROCscreen
  120REPEAT
  130FORO%=0TOQ%:NEXT:E%=0:H%=H%+1:CA
LLkeys:IFK%=183PROCfreeze
  140IFADVAL(-6)=0 GOTO170
  150READA,B,C:IFA=999RESTORE6000:REA
DA,B,C:O=O+4:IFO=12O=0
  160SOUND1,-12,A+O,C:SOUND2,-7,B+O,C
  170IFH%=60H%=2:X%?1=X%?59:Y%?1=Y%?5
9:T?1=T?59
  180A%=?(X%+H%-1)-(D%=194)+(D%=225):
Y%?H%=?(Y%+H%-1)+(D%=200)-(D%=232)
  190L=T+H%-1:IF(D%=225ORD%=194)AND(?
L=200OR?L=232)ANDA%<>?(X%+H%-1) ?L=D%
  200IF(D%=200ORD%=232)AND(?L=225OR?L
=194)ANDY%?H%<>?(Y%+H%-1) ?L=D%
  210IFA%=-1 A%=19:D%=225
  220IFA%=20 A%=0:D%=194
  230T?H%=D%:B%=Y%?H%:X%?H%=A%:C%=?(D
+20*B%+A%)
  240IFC%=1ORdata?3=1ORB%=3ORB%=30:I%
=I%-Z%:Z%=-1:GOTO330
  250IFC%=2Z%=Z%-1:E%=1:S%=S%+100:SOU
ND3,2,10,4
  260IFC%=2 THEN *fx 13 4
  270IFC%=2 PRINTTAB(1,1)FNf(S%,6):*f
x14 4
  280CALLhead:A%=?(X%+H%-1):B%=?(Y%+H
%-1):CALLbody:?(D+20*B%+A%)=1
  290IFE%<>0 GOTO330
  300A%=X%?T%:B%=Y%?T%:CALLerase:?(D+
20*B%+A%)=0
  310T%=T%+1:IFT%=60T%=2:X%?1=X%?59:Y
%?1=Y%?59:T?1=T?59
  320A%=X%?T%:B%=Y%?T%:?&70=T?T%:CALL
tail:?(D+20*B%+A%)=1
  330UNTILZ%<1
  340IFZ% PROCdead ELSEPROCbonus
  350UNTILL%=0
  360PROCprint(330,650,"GAME  OVER")
  370TIME=0:REPEAT UNTILTIME>200
  380RESTORE5980
  390FORN%=1TO8:READA,B:FORL=1TO3:SOU
NDL,4,A,B:NEXT:NEXT
  400TIME=0:REPEAT UNTILTIME>200
  410PROCtable
  420UNTIL0
  430END
  440DEFFNf(A%,B%):PRINTRIGHT$("00000
"+STR$A%,B%);
  450IFS%>=P%ANDL%<7SOUND3,2,50,6:L%=
L%+1:P%=P%+50000:O%=A%:W%=B%:B%=2:A%=
L%+6:CALLup:A%=O%:B%=W%:="" ELSE=""
  460DEFPROCfreeze
  470PRINTTAB(3,2);">>> freeze <<<"
  480PROCpause
  490B%=3
  500FORA%=0TO19
  510IFA%MOD2 CALLwall ELSE CALLwall2
  520NEXT
  530*fx14,4
  540ENDPROC
  550DEFPROCpause
  560*fx13 4
  570C%=177
  580*fx15
  590REPEATUNTIL?&EC=0 AND?&ED=0
  600REPEAT
  610PROCwait
  620CALLkeys
  630UNTILK%<>0
  640*fx15
  650RESTORE6000
  660ENDPROC
  670DEFPROCerase(I)
  680*fx13 4
  690*fx15
  700FORN%=1TOI%
  710A%=?(X%+T%):B%=?(Y%+T%)
  720T%=T%+1:IFT%=60T%=2:X%?1=X%?59:Y
%?1=Y%?59
  730IFZ% CALLsplat
  740SOUND0,-15,2,2
  750SOUND1,-10,N%,1
  760FORN=1TO35:NEXT
  770SOUND0,0,0,0
  780CALLerase
  790S%=S%+I
  800PRINTTAB(1,1);FNf(S%,6)
  810FORN=1TO65:NEXT
  820NEXT
  830ENDPROC
  840DEFPROCdead
  850SOUND0,-9,5,2
  860PROCerase(10)
  870IFdata?3=0 A$="You're DEAD!" ELS
E A$="Out of Time"
  880PROCprint(286,850,A$)
  890L%=L%-1
  900RESTORE5870
  910FORN%=1TO11
  920READA%,B%
  930SOUND3,2,A%,B%
  940SOUND2,-4,A%,B%
  950SOUND1,-15,A%,B%
  960FORL=1TO3:SOUNDL,0,0,1:NEXT:NEXT
  970FORN=1TO800:NEXT
  980ENDPROC
  990DEFPROCbonus
 1000PROCerase(50)
 1010FORN=10*?data+data?1 TO0STEP-1
 1020SOUND0,-10,4,1
 1030S%=S%+75
 1040PRINTTAB(1,1);FNf(S%,6);TAB(9,0)
;
 1050COLOUR2
 1060PRINTRIGHT$("00"+STR$(N),2)
 1070SOUND0,0,0,0
 1080NEXT
 1090Q%=Q%-1
 1100R%=R%+4:IFR%=60R%=32:Q%=Q%-2
 1110B=FR%*200
 1120SOUND0,0,0,1
 1130PROCprint(260,832,"Next Pattern"
)
 1140COLOUR3
 1150PRINTTAB(5,11);
 1160$&110="BONUS:":CALLdouble
 1170COLOUR2
 1180$&110=RIGHT$("000"+STR$B,4):CALL
double
 1190FORN=1TO330:NEXT
 1200FORN%=1TOB/100
 1210S%=S%+100:B=B-100
 1220PRINTTAB(1,1)FNf(S%,6)TAB(11,11)
;
 1230SOUND0,-12,4,2
 1240$&110=RIGHT$("000"+STR$B,4):CALL
double
 1250SOUND0,0,0,0
 1260NEXT
 1270FR%=FR%+1
 1280RESTORE5850
 1290FORN%=1TO25
 1300READA%,B%
 1310IFA%=0 V%=0 ELSEV%=2
 1320A%=A%+1
 1330SOUND1,V%,A%,B%
 1340SOUND2,-9,A%,B%
 1350SOUND3,-4,A%,B%
 1360FORL=1TO3:SOUNDL,0,0,1:NEXT:NEXT
 1370FORN=1TO700:NEXT
 1380ENDPROC
 1390DEFPROCprint(A,B,B$)
 1400VDU5
 1410FORN%=1TO3
 1420GCOL0,2-(N%=1)+(N%=2)
 1430MOVEA+6*N%,B+6*N%
 1440$&110=B$:CALLdouble
 1450NEXT
 1460VDU4
 1470ENDPROC
```

→

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```
 1480DEFPROCtable
 1490PROCblack
 1500line=0
 1510COLOUR128:CLS
 1520PROCprint(270,960,"High Scores")
 1530IFS%>score%(9) PROCswap
 1540FORN%=1TO9
 1550X=N%*2+4
 1560COLOUR1
 1570PRINTTAB(0,X);N%;")"
 1580COLOUR2
 1590PRINTTAB(2,X);name$(N%);TAB(18,X
);FNf(frame%(N%),2)
 1600COLOUR3
 1610PRINTTAB(11,X);RIGHT$("      "+ST
R$score%(N%),6)
 1620NEXT
 1630IFline<>0 PROCinput
 1640PROCprint(270,120,"Press Any Key
")
 1650IFline=0 PROCcolours
 1660C%=176
 1670*fx15
 1680REPEAT
 1690PROCwait
 1700UNTILC%=45ORINKEY$0<>""
 1710*fx15
 1720PROCblack
 1730ENDPROC
 1740DEFPROCswap
 1750score%(9)=S%:frame%(9)=FR%:name$
(9)="":line=9
 1760FORL%=8TO1STEP-1
 1770IFscore%(L%+1)>score%(L%) PROCex
change
 1780NEXT
 1790ENDPROC
 1800DEFPROCexchange
 1810s=score%(L%):score%(L%)=score%(L
%+1):score%(L%+1)=s
 1820s=frame%(L%):frame%(L%)=frame%(L
%+1):frame%(L%+1)=s
 1830s$=name$(L%):name$(L%)=name$(L%+
1):name$(L%+1)=s$
 1840line=L%
 1850ENDPROC
 1860DEFPROCinput
 1870PRINTTAB(5,25);FNtext("Please en
ter",3);''TAB(6);FNtext("your name.",
3)
 1880PROCcolours
 1890Y=line*2+4
 1900PRINTTAB(3,Y);
 1910RESTORE5880
 1920FORN%=1TO18:READA,B:FORL=1TO3:SO
UNDL,-17+2*L,A,B:NEXT:NEXT
 1930FORL=1TO1000:NEXT
 1940*fx15
 1950L=0:a$=""
 1960SOUND1,2,25,6
 1970TIME=0
 1980REPEAT
 1990COLOUR1
 2000PRINTTAB(L+2,Y);"_";
 2010REPEAT
 2020a=INKEY0
 2030UNTILTIME>2000 ORa=13 OR a=127 O
R(a>64 ANDa<122)ORa=32
 2040COLOUR3
 2050IFa>31 ANDa<127 ANDL<8 L=L+1:VDU
8,a:a$=a$+CHR$a
 2060IFa=127 ANDL>0 VDU127:L=L-1:a$=L
EFT$(a$,L)
 2070UNTILa=13 ORLEN(a$)=8 ORTIME>200
0
 2080IFa$="" a$="Fred"
 2090IFLEN(a$)<>8 PRINTTAB(L+2,Y);" "
 2100name$(line)=a$
 2110COLOUR2
 2120SOUND1,2,25,6
 2130PRINTTAB(2,Y);a$
 2140PRINTTAB(5,25);SPC(90)
 2150ENDPROC
 2160DEFPROCinitialise
 2170*fx11
 2180*fx16
 2190ENVELOPE1,1,3,-90,1,1,-2,-3,126,
0,0,-126,126,126
 2200ENVELOPE2,1,1,-2,1,7,5,12,126,0,
0,-126,126,126
 2210ENVELOPE3,1,0,0,0,10,10,10,126,-
4,-1,-4,126,0
 2220ENVELOPE4,2,0,0,0,0,0,0,64,-7,0,
0,126,0
 2230VDU23;8202;0;0;0;
 2240VDU23,0,1,0;0;0;0;
 2250VDU19,0,4;0;19,1,1;0;19,2,3;0;19
,3,0;0;
 2260rnd=RND(-TIME)
 2270DIMD 700,W%1000,name$(9),score%(
9),frame%(9),rock(2)
 2280X%=&B00:Y%=&B50:T=&BA0
 2290name$(1)="Penfold":score%(1)=134
825:frame%(1)=14
 2300FORN%=2TO9
 2310name$(N%)="Acorn"
 2320score%(N%)=225*(11-N%)
 2330frame%(N%)=1
 2340NEXT
 2350PROCassemble
 2360ENDPROC
 2370DEFPROCtitles
 2380COLOUR1:COLOUR128:CLS
 2390FORN%=1TO58
 2400PRINT"  C.Dunkley";
 2410NEXT
 2420COLOUR3
 2430PRINTTAB(5,28);FNtext("C.Dunkley
",4)
 2440PROCprint(330,1000,"Fruit Worm")
 2450PROCprint(240,70,"Press Any Key"
)
 2460VDU24,80;170;1236;910;
 2470GCOL0,131:CLG
 2480VDU28,1,25,18,3
 2490COLOUR3:COLOUR130:CLS
 2500PRINT'"  Guide the worm  around
the screen,eating: , , , , ."
 2510PRINT''"  A worm is lost  if you
 run into   either:  , , or ."
 2520PRINT'"  Extra worms are awarded
 for every 50,000 pts scored."
 2530COLOUR1
 2540PRINT''FNtext("   CONTROLS:  ",3
);FNtext("*",2);SPC(16);FNtext("Z X",
2);SPC(16);FNtext("?",2);
 2550PRINT''FNtext("   P ",2);FNtext(
"- Pause ",3);:COLOUR3:PRINTFNtext("O
N",1)
 2560B%=6
 2570FORN%=0TO4
 2580A%=8+2*N%
 2590L=fruit+16*N%
 2600?&72=L MOD256:?&73=L DIV256
 2610CALLprint
 2620NEXT
 2630B%=11
 2640A%=8:CALLwall
 2650A%=9:CALLwall2
 2660A%=11:CALLrock(1)
 2670A%=13:CALLrock(2)
 2680A%=16:CALLbody
 2690RESTORE5990
 2700PROCcolours
 2710FORN%=1TO10:READA,B:FORL=1TO3:SO
UNDL,-13+L,A,B:NEXT:NEXT
 2720FORL=1TO3000:NEXT
 2730PROCpause
 2740S%=0:L%=3:R%=8:FR%=1:P%=50000:Q%
=384:VDU26
 2750ENDPROC
 2760DEFPROCwait
 2770t=4
 2780C%=C%+1
 2790IFC%>200 C%=1:RESTORE5900
 2800IFC%>0 ANDC%<17 t=1
 2810IFC%>46 ANDC%<67 t=2
 2820IFC%>105 ANDC%<148 t=3
 2830IFt=4 FORloop=1TO250:NEXT:ENDPRO
C
 2840READA,B
 2850IFt=1 FORL=1TO3:SOUNDL,3,A+1,B:N
EXT:ENDPROC
```

→

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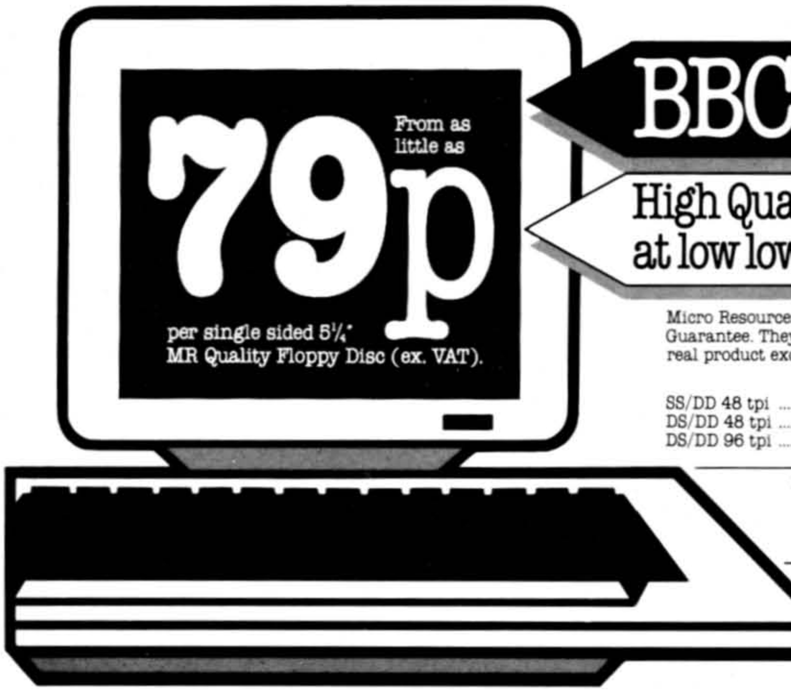

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```
 2860IFt=2 FORL=1TO3:SOUNDL,-14+L*2,A
,B:NEXT:ENDPROC
 2870FORL=1TO3:SOUNDL,(17-2*L)*(A<>0)
,A,B:NEXT
 2880ENDPROC
 2890DEFPROCscreen
 2900PROCblack
 2910COLOUR128:CLS
 2920FORA%=1TO29
 2930FORB%=0TO19 STEP4
 2940!(D+B%+A%*20)=0
 2950NEXT:NEXT
 2960COLOUR129:COLOUR3
 2970PRINTTAB(19,31);" ";TAB(0,0);STR
ING$(40," ");TAB(0,30);STRING$(39," "
);
 2980FORA%=0TO19
 2990IFA%MOD2 brick=wall ELSE brick=w
all2
 3000B%=3:CALLbrick
 3010B%=30:CALLbrick
 3020NEXT
 3030GCOL0,1
 3040MOVE0,64:DRAW1279,64
 3050PRINTTAB(1,30);FNtext("FR:",2);T
AB(3,0);FNtext("SC",2);SPC(10);FNtext
("HI",2)
 3060COLOUR2
 3070PRINTTAB(1,1);FNf(S%,6);SPC(6);F
Nf(score%(1),6)TAB(4,30);FNf(FR%,2);
 3080P=D+209
 3090!P=&01010101:P?22=1
 3100B%=10:A%=10:CALLright
 3110A%=9:CALLtright
 3120FORN%=1TOL%
 3130A%=N%+6
 3140B%=2:CALLup
 3150NEXT
 3160PROCprint(375,50,"Fruit Worm")
 3170Z%=R%:I%=Z%+2
 3180FORN%=2TOZ%/4
 3190REPEAT
 3200PROClocate(0,fini)
 3210N=0
 3220FORY=-1TO1
 3230FORX=-1TO1
 3240IF?(L+20*Y+X)=1 N=N+1
 3250NEXT:NEXT
 3260UNTILN<4
 3270?L=1
 3280CALLrock(RND(2))
 3290NEXT
 3300FORN%=1TOZ%
 3310L=fruit+16*RND(5)-16
 3320?&72=L MOD256:?&73=L DIV256
 3330PROClocate(2,print)
 3340NEXT
 3350time=Z%+10
 3360PRINTTAB(9,0);FNf(time,2)
 3370PROCcolours
 3380RESTORE
 3390FORN%=1TO17
 3400READA%,B%
 3410IFN%<>10 A%=A%+1
 3420IFA%=0 V%=0 ELSEV%=2
 3430SOUND&101,V%,A%,B%
 3440SOUND&102,-12,A%,B%
 3450SOUND3,-4,A%,B%
 3460FORN=1TO3:SOUNDN,0,0,1:NEXT:NEXT
 3470D%=194:K%=0
 3480H%=2:T%=1
 3490T?1=225
 3500X%?1=9:Y%?1=10
 3510X%?2=10:Y%?2=10
 3520P?22=0:P?2=0:P?3=0:O=0
 3530FORN=0TO2000:NEXT
 3540PROCpause
 3550RESTORE6000
 3560data?3=0
 3570data?2=50
 3580?data=time DIV10
 3590data?1=time MOD10
 3600*fx14 4
 3610ENDPROC
 3620DEFPROClocate(a,b)
 3630REPEAT
 3640A%=RND(20)-1:B%=RND(26)+3:L=D+B%
*20+A%
 3650UNTIL?L=0
 3660?L=a:CALLb
 3670ENDPROC
 3680DEFPROCcolours
 3690PROCscroll(1,40,1)
 3700ENDPROC
 3710DEFPROCblack
 3720PROCscroll(40,1,-1)
 3730VDU23,0,1,0;0;0;0;
 3740ENDPROC
 3750DEFPROCscroll(A,B,C)
 3760FORXX=A TO B STEPC
 3770VDU23,0,1,XX;0;0;0;
 3780IFXX<33 VDU23,0,6,XX;0;0;0;
 3790FORY=1TO20
 3800NEXT:NEXT
 3810ENDPROC
 3820DEFFNtext(S$,C)
 3830LOCALX%,Y%
 3840A%=10:X%=&70
 3850FORC%=1TOLENS$
 3860?&70=ASC(MID$(S$,C%,1))
 3870IF?&70=32 VDU32:GOTO3950
 3880CALL&FFF1
 3890IFC=1 ORC=4 FORN%=0TO2:N%?&71=N%
?&71/2:?(&78-N%)=2*?(&78-N%):NEXT
 3900IFC=2 ORC=4 FORN%=0TO7:N%?&71=N%
?&71 OR2*N%?&71:NEXT
 3910IFC=3 FORN%=0TO3:N%?&71=N%?&71 O
RN%?&71*2:NEXT
 3920VDU23,255
 3930FORN%=0TO7:VDUN%?&71:NEXT
 3940VDU255
 3950NEXT
 3960=""
 3970DEFPROCassemble
 3980FORN%=0TO2STEP2
 3990P%=W%:[OPTN%
 4000.erase
 4010LDA#erase_data MOD256:STA&72
 4020LDA#erase_data DIV256:STA&73
 4030JMPprint
 4040.rock(1)
 4050LDA#rock_data MOD256:STA&72
 4060LDA#rock_data DIV256:STA&73
 4070JMPprint
 4080.rock(2)
 4090LDA#rock2_data MOD256:STA&72
 4100LDA#rock2_data DIV256:STA&73
 4110JMPprint
 4120.splat
 4130LDA#splat_data MOD256:STA&72
 4140LDA#splat_data DIV256:STA&73
 4150JMPprint
 4160.left
 4170LDA#left_data MOD256:STA&72
 4180LDA#left_data DIV256:STA&73
 4190JMPprint
 4200.right
 4210LDA#right_data MOD256:STA&72
 4220LDA#right_data DIV256:STA&73
 4230JMPprint
 4240.up
 4250LDA#up_data MOD256:STA&72
 4260LDA#up_data DIV256:STA&73
 4270JMPprint
 4280.down
 4290LDA#down_data MOD256:STA&72
 4300LDA#down_data DIV256:STA&73
 4310JMPprint
 4320.body
 4330LDA#body_data MOD256:STA&72
 4340LDA#body_data DIV256:STA&73
 4350JMPprint
 4360.wall
 4370LDA#wall_data MOD256:STA&72
 4380LDA#wall_data DIV256:STA&73
 4390JMPprint
 4400.wall2
 4410LDA#wall2_data MOD256:STA&72
 4420LDA#wall2_data DIV256:STA&73
 4430JMPprint
 4440.tleft
 4450LDA#mleft_data MOD256:STA&72
 4460LDA#mleft_data DIV256:STA&73
```

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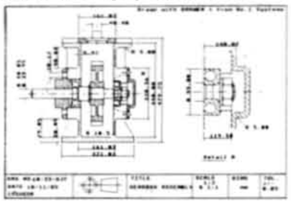

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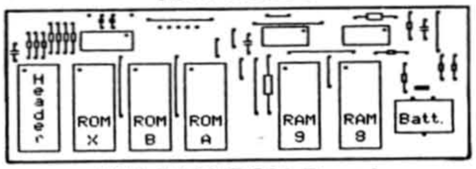

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From Page 99

```
4470JMPprint
4480.tright
4490LDA#mright_data MOD256:STA&72
4500LDA#mright_data DIV256:STA&73
4510JMPprint
4520.tup
4530LDA#mup_data MOD256:STA&72
4540LDA#mup_data DIV256:STA&73
4550JMPprint
4560.tdown
4570LDA#mdown_data MOD256:STA&72
4580LDA#mdown_data DIV256:STA&73
4590JMPprint
4600.fruit
4610OPT FNequd(&03896600):OPT FNequd
(&01030707):OPT FNequd(&0C088866):OPT
FNequd(&080CC24A)
4620OPT FNequd(&11001166):OPT FNequd
(&062D0622):OPT FNequd(&06CC0000):OPT
FNequd(&0000062D)
4630OPT FNequd(&65329966):OPT FNequd
(&3354ADDA):OPT FNequd(&A24C9966):OPT
FNequd(&CC6AB553)
4640OPT FNequd(&2240A440):OPT FNequd
(&01030011):OPT FNequd(&64522000):OPT
FNequd(&0C0E8888)
4650OPT FNequd(0):OPT FNequd(&66FFFF
66):OPT FNequd(&88AAAACC):OPT FNequd(
&00008888)
4660.wall_data  OPT FNequd(&FF1F1FFF
):OPT FNequd(&00FF8F8F):OPT FNequd(&F
F1F1FFF):OPT FNequd(&00FF8F8F)
4670.wall2_data OPT FNequd(&FF2F2FFF
):OPT FNequd(&00FF8F8F):OPT FNequd(&F
F2F2FFF):OPT FNequd(&00FF8F8F)
4680.erase_data OPT FNequd(0):OPT FN
equd(0):OPT FNequd(0):OPT FNequd(0)
4690.splat_data OPT FNequd(&7D657FAA
):OPT FNequd(&1253DABB):OPT FNequd(&A
ABBCCDD):OPT FNequd(&11002200)
4700.rock_data  OPT FNequd(&31101010
):OPT FNequd(&F0F76371):OPT FNequd(&6
CECC880):OPT FNequd(&C0FC3E3E)
4710.rock2_data OPT FNequd(&07120100
):OPT FNequd(&10101043):OPT FNequd(&4
A0C0800):OPT FNequd(&8080800E)
4720.body_data  OPT FNequd(&DFAF5733
):OPT FNequd(&3367DFAF):OPT FNequd(&5
DBB6ECC):OPT FNequd(&CCAE5FBF)
4730.left_data  OPT FNequd(&DF763311
):OPT FNequd(&112356AF):OPT FNequd(&5
FBF6ECC):OPT FNequd(&CCAE5FBF)
4740.right_data OPT FNequd(&AFDF6733
):OPT FNequd(&3357AFDF):OPT FNequd(&B
FE6CC88):OPT FNequd(&884CA65F)
4750.up_data    OPT FNequd(&FD673311
):OPT FNequd(&3367DFAF):OPT FNequd(&5
BAE4C88):OPT FNequd(&CCAE5FBF)
4760.down_data  OPT FNequd(&DFAF5733
):OPT FNequd(&112357AD):OPT FNequd(&5
FBF6ECC):OPT FNequd(&88CC6EFB)
4770.mup_data   OPT FNequd(&67576733
):OPT FNequd(&00112333):OPT FNequd(&A
E6EAECC):OPT FNequd(&0088CC4C)
4780.mdown_data OPT FNequd(&23331100
):OPT FNequd(&33576757):OPT FNequd(&C
C4C8800):OPT FNequd(&CC6EAE6E)
4790.mleft_data OPT FNequd(&DFAF7700
):OPT FNequd(&0077DFAF):OPT FNequd(&6
ECC0000):OPT FNequd(&0000CCAE)
4800.mright_data OPT FNequd(&5733000
0):OPT FNequd(&00003367):OPT FNequd(&
5FBFEE00):OPT FNequd(&00EE5FBF)
4810.print
4820LDA#HIMEM MOD256:STA&74
4830LDA#HIMEM DIV256:STA&75
4840LDA&404:ASLA:ASLA:TAX:LDY#4
4850.loop1
4860TXA:CLC:ADC&74:STA&74:BCCn1:INC&
75
4870.n1
4880DEY:BNEloop1
4890LDA&408:ASLA:ASLA:ASLA:TAX:LDY#4
0
4900.loop2
4910TXA:CLC:ADC&74:STA&74:BCCn2:INC&
75
4920.n2
4930DEY:BNEloop2
4940LDY#0
4950.loopP
4960LDA(&72),Y:STA(&74),Y:INY:CPY#16
:BNEloopP:RTS
4970.keys
4980LDA&EC:LDX&ED
4990BEQcontkeys
5000TXA
5010.contkeys
5020STA&42C
5030CMP#225:BEQyes
5040CMP#194:BEQyes
5050CMP#200:BEQyes
5060CMP#232:BNEhomekeys
5070.yes
5080STA&410
5090.homekeys
5100RTS
5110.head
5120LDA&410
5130CMP#225:BNEnotleft:JMPleft
5140.notleft
5150CMP#194:BNEnotright:JMPright
5160.notright
5170CMP#200:BNEnotup:JMPup
5180.notup
5190JMPdown
5200.tail
5210LDA&70
5220CMP#225:BNEntleft:JMPtleft
5230.ntleft
5240CMP#194:BNEntright:JMPtright
5250.ntright
5260CMP#200:BNEntup:JMPtup
5270.ntup
5280JMPtdown
5290.double
5300LDA#0:PHA
5310.loopD1
5320PLA:TAX:LDA&110,X:CMP#13:BEQfini
5330STA&80
5340INX:TXA:PHA
5350LDX#&80:LDY#0:LDA#10:JSR&FFF1
5360LDA#23:JSR&FFEE:LDA#255:JSR&FFEE
5370LDY#1
5380.loopD2
5390LDA&80,Y:JSR&FFEE:JSR&FFEE
5400INY:CPY#5:BNEloopD2
5410LDA#255:JSR&FFEE:LDA#8:JSR&FFEE:
LDA#10:JSR&FFEE
5420LDA#23:JSR&FFEE:LDA#255:JSR&FFEE
5430.loopD3
5440LDA&80,Y:JSR&FFEE:JSR&FFEE
5450INY:CPY#9:BNEloopD3
5460LDA#255:JSR&FFEE:LDA#11:JSR&FFEE
5470JMPloopD1
5480.fini RTS
5490.timer
5500STA&80
5510DECdata+2
5520BEQdec_time
5530LDA&80:RTS
5540.dec_time
5550LDA#50:STAdata+2
5560STX&81:STY&82
5570LDA#31:JSR&FFEE
5580LDA#9:JSR&FFEE
5590LDA#0:JSR&FFEE
5600LDAdata+1
5610BNEdec
5620LDA#9:STAdata+1
5630DECdata
5640JMPfini_time
5650.dec
5660DECdata+1
5670LDAdata:BEQdead
5680.fini_time
5690LDAdata:CLC:ADC#48:JSR&FFEE
5700LDAdata+1:CLC:ADC#48:JSR&FFEE
5710LDA&80:LDX&81:LDY&82:RTS
5720.dead
5730LDAdata+1:BNEfini_time
5740LDA#1:STAdata+3
5750JMPfini_time
```

→

From Page 101

```
 5760 .data OPT FNequd(0)
 5770]:NEXT
 5780?&220=timer MOD256:?&221=timer D
IV256
 5790ENDPROC
 5800DEFFNequd(A)
 5810!P%=A:P%=P%+4
 5820=N%
 5830DATA136,2,128,2,136,12,128,2,120
,2,116,2,108,2,104,8,108,16,0,2,136,2
 5840DATA128,2,136,12,116,6,120,6,104
,6,108,8
 5850DATA108,1,116,1,108,1,100,1,96,1
,80,1,80,2,88,1,96,1,88,1,80,1,76,1
 5860DATA60,1,60,2,108,1,116,1,108,1,
100,1,96,1,80,1,80,1,96,1,68,2,76,4,8
0,4
 5870DATA68,8,68,6,68,2,68,8,80,6,76,
2,76,4,68,4,68,6,64,2,68,8
 5880DATA101,5,121,3,137,5,121,2,129,
2,121,2,129,2,121,4,117,3,101,5,121,3
 5890DATA137,5,121,2,129,2,121,2,129,
2,121,4,117,3
 5900DATA121,2,141,8,141,8,149,8,149,
8,169,14,157,2,141,6,141,2,157,6,141,
2
 5910DATA129,8,161,16,149,6,137,2,141
,16
 5920DATA53,5,69,5,81,6,89,3,81,5,69,
5,53,5,69,5,81,6,89,3,81,5,69,5,53,5
 5930DATA69,5,81,15,89,15,73,6,69,3,7
3,5,61,10
 5940DATA101,5,121,5,0,0,121,5,117,3,
109,2,117,4,121,5,101,4,0,1,101,4,0,1
 5950DATA101,4,121,5,0,0,121,5,117,2,
109,2,117,4,121,5,101,4,0,1,101,4,0,1
 5960DATA101,4,89,5,0,0,89,5,81,5,0,0
,81,5,73,6,0,7,101,5,89,5,0,0
 5970DATA89,5,81,5,0,0,81,5,73,6,0,10
 5980DATA101,8,81,8,101,16,117,4,121,
4,109,4,117,4,101,16
 5990DATA129,9,117,4,121,4,129,9,101,
9,121,4,129,4,137,4,145,4,149,4
 6000DATA165,101,5,157,101,5,149,101,
5,177,97,5,177,89,5,177,81,5,165,101
 6010DATA5,157,101,5,149,101,5,177,97
,5,177,89,5,177,81,5,165,101,5,157
 6020DATA101,5,149,101,5,169,109,5,16
5,109,5,169,101,5,177,97,5,169,97
 6030DATA5,165,101,5,157,81,5,157,89,
5,97,97,5,165,101,5,157,101,5,149
 6040DATA101,5,177,97,5,177,89,5,177,
81,5,165,101,5,157,101,5,149,101,5
 6050DATA177,97,5,177,89,5,177,81,5,1
65,101,5,169,101,5,165,101,5,157,89
 6060DATA5,165,89,5,157,89,5,149,101,
15,149,101,10,999,0,0
 6070*FX18
 6080*KEY0 *TAPE|M FORI%=0TO TOP-PAGE
 STEP4:I%!&E00=I%!PAGE:N.|MPAGE=&E00|
MO.|MRUN|F|M
 6090MODE7:PRINT'"DOWNLOADING":VDU21:
*FX138,0,128
```

This listing is included in this month's cassette tape offer. See order form on Page 141.

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of sectors.
names while
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disc. For this
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the sector
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should refer to
S manual if in
ch track and
ple catalogues.
ment, load the
then type in

am ended by
he disc. I prefer
y to accidentally
Wordwise.
'er, the files may

Branching out with the Disc Scanner

By GEOFF TURNER

be left locked or unlocked as they were originally found on the disc by adding Program II to the original program.

Remember to delete the lines specified in line 0. This amendment leaves the files as found, and only unlocks them if they are to be deleted.

A further modification I found useful is to allow the scanner to work in 80 column mode. The original program ran in 40 column Mode 7, but by using Mode 3 twice as much data can be examined at once. Users with a monitor suitable for reading 80 column may prefer this. The amendments are shown in Program III. Again, remember to delete the lines shown in line 0.

The three listings have been numbered so that any combination of the three may be added to the original program.

```
   0 REM DELETE LINES 460,470,900,91
0
 992 dir$=RIGHT$(F$,1)
 993 IF ASC(dir$)>128 THEN dir$=CHR$
(ASC(dir$)-128)
1000 F$=dir$+"."+LEFT$(F$,7)
1405 PROCunlock
2290 DEFPROCunlock
2300 $&4000="ACCESS"+F$
2310 X%=&00
2320 Y%=&40
2330 CALL &FFF7
2340 ENDPROC
```

Program II

```
                          2120 PRINTTAB(5,9);"Track No. (0-39)
                           ";
                          2130 INPUT track%
                          2140 UNTIL track%>-1 AND track%<40
)";"Insert disc in        2150 REPEAT
                          2160 PRINTTAB(0,11);SPC(40):VDU7
                          2170 PRINTTAB(5,11);"Sector No. (0-9
                          ) ";
;"ENTER DRIVE NO."        2180 INPUT sector%
                          2190 UNTIL sector%>-1 AND sector%<10
);SPC(40):VDU7            2200 CLS
);"Drive No. (0-3)        2210 ENDPROC
                          2220 DEFPROCdrive
;                         2230 drive$="DRIVE"+STR$(drive%)
%>-1 AND drive%<4         2240 $&4000=drive$
                          2250 X%=&00
7);"ENTER CATALOGUE"      2260 Y%=&40
                          2270 CALL &FFF7
,9);SPC(40):VDU7          2280 ENDPROC
```

```
   0 REM DELETE LINES 720,760,870,89
0,1250,1280,1350,1380
 665 MODE3
 666 COLOUR 135:COLOUR 0
 667 PRINTTAB(26,1);"THE G.T. DISC S
CANNER"
 668 COLOUR 128:COLOUR 7
 745 COLOUR 135:COLOUR 0
 750 PRINTTAB(22,23);" SCANNING FILE
NAME - ";F$;
 755 COLOUR 128:COLOUR 7
 770 VDU 28,0,21,79,3
 820 VDU 28,0,24,79,3
 860 PRINTTAB(0,23);SPC(75);
 875 COLOUR 135:COLOUR 0
 880 PRINTTAB(22,23);" ALL FILES SCA
NNED ";
 885 COLOUR 128:COLOUR 7
1120 IF POS=79 OR N=13 count%=count%
+1
1260 PRINTTAB(0,23);SPC(75);
1265 COLOUR 135:COLOUR 0
1270 PRINTTAB(22,23);F$;" - END OF F
ILE REACHED";
1275 COLOUR 128:COLOUR 7
1290 VDU 28,0,22,79,2
1360 PRINTTAB(0,23);SPC(75);
1365 COLOUR 135:COLOUR 0
1370 PRINTTAB(24,23);F$;" - DELETE (
Y/N) ? ";
1375 COLOUR 128:COLOUR 7
1450 VDU28,0,21,79,3
```

Program III

Using the 1770 FDC to full effect

MIKE STALLYBRASS looks at the floppy disc controller that has replaced the out-dated 8271

AMONG computer buffs there's more and more talk about the merits of single and double density disc systems, and of the problems of using the increasingly popular WD 1770 floppy disc controller to emulate the original and still widely used 8271.

Quite a bit has been written about the old 8271, but much less has been said about its arch rival, so in this article I shall try and even the balance.

At the end of 1982 the only way to use discs was to acquire the Acorn DFS upgrade, consisting of the 8271 and a supporting cast of nine other plug-in chips, all for around £80 – always assuming you could find a dealer with the upgrade in stock.

By mid 1983 the price for the upgrade had risen to about £110, with fitting often an extra £20. The prime cause of the rise in price was a world-wide shortage of 8271 FDC chips.

Intel, unaware of Acorn it seemed, had decided to cease production of this vintage chip. Thus price, availability and criticisms of some aspects of the Acorn system had set the scene for the appearance of alternative disc upgrades.

Some upgrades just provided different software but still relied on the 8271 FDC. Simply by providing alternative software they were able to ease the limitation on the number of files on a disc and increase the range of commands available, thus eliminating the need for a separate utilities disc.

But some were more radical and changed the FDC chip that was used – either a WD 1797 or, later, a WD 1770 were used instead. If you upgraded in this way you lost out on compatibility, but gained on availability and on cost – typically £20 less than the Acorn kit.

As a bonus you were given the ability to cram more data on to your discs due to the increased capacity offered by using double density recording. However the 1797 FDC chip, although not as ancient as the 8271 FDC, was soon left behind. The WD 1770, a development of the earlier 1797, became the accepted alternative, and as competing upgrade kits multiplied the prices fell. Indeed by mid 1984 you could get an upgrade kit for as little as £40 if using the WD1770 FDC, though the official Acorn kit was then still selling for around £115.

Today the majority of alternative disc upgrades are based around the WD 1770 FDC, and even Acorn has abandoned the 8271 in its newer models in favour of the 1770, although the earlier price and availability problems of the 8271 are now far less severe.

Even when the BBC Micro was originally launched some observers expressed surprise at the choice of the 8271 FDC. It was already very long in the tooth – after all it had been designed for controlling 8in disc drives. However by 1982 such drives had been effectively displaced by the rather newer 5.25in standard.

The chip's facilities, with its bad track registers and automatic stepping into the next track if a seek fails to find the expected track, reflect the lower standards of reliability of the 1970s. And of course it can only work in single density mode.

So you might be wondering how the 8271 and the 1770 FDCs compare? If you have bought a disc upgrade utilising the WD 1770 FDC you may well have been struck by two things.

Firstly, the 1770 FDC is a 28 pin

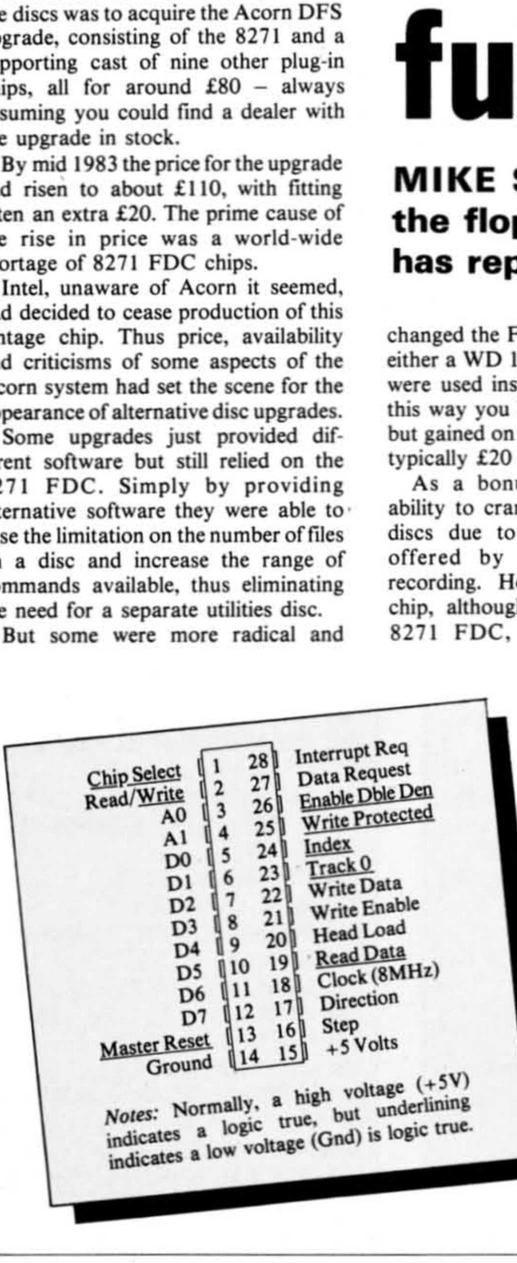

Chip Select 1 28 Interrupt Req
Read/Write 2 27 Data Request
A0 3 26 Enable Dble Den
A1 4 25 Write Protected
D0 5 24 Index
D1 6 23 Track 0
D2 7 22 Write Data
D3 8 21 Write Enable
D4 9 20 Head Load
D5 10 19 Read Data
D6 11 18 Clock (8MHz)
D7 12 17 Direction
Master Reset 13 16 Step
Ground 14 15 +5 Volts
Notes: Normally, a high voltage (+5V) indicates a logic true, but underlining indicates a low voltage (Gnd) is logic true.

Figure I: 1770 FDC pin configuration

chip, while the socket left for the 8271 was a 40 pin one – see Figures I and II. This means that the 1770 has to be mounted on a separate board – along with some extra chips – which then plugs into the 8271 socket.

Secondly, you had rather fewer than nine other chips to add to the waiting sockets. This is because seven out of the nine remaining chips in the Acorn system are needed to help the 8271 decode signals from the disc.

It might seem surprising that while the 8271 supplied both clock and data signals when writing to the disc it could not by itself interpret the mixed clock and data signals that came back when reading a disc, and needed the extra chips to separate the data out. By contrast the WD 1770 chip does all the decoding when reading, as well as all the encoding when writing.

In general terms the interface to the 1770 chip is simpler than that with the 8271. The 1770 chip has rather fewer registers than the 8271, having eight (four write and four read registers) as opposed to 28, and they are all directly addressable – see Table I.

Table I: Address space for 1770

Address	Write	Read
&FE80	Command register	Status register
&FE81	Current track	Current track
&FE82	Current sector	Current sector
&FE83	Write data	Read data

There are also fewer software commands. For ease of description they can be split into four groups – see Table II. The first group consists of positioning commands, the second of sector related commands, the third of track related commands and the fourth interrupt commands.

The command is identified by the most significant four bits written to the command register. The other four bits are used to select various options as required. For all commands in groups I, II and III there is a spin-up sequence option. This is selected by setting bit 3 of the command byte to 0.

When selected, if the drive motor is not already on, the FDC will switch on the drive motor and then wait for six complete revolutions of the disc before executing the command. At the standard spindle speed of 300 RPM this ensures a one second delay for the disc to get up to speed.

After any command has finished the motor is automatically switched off if another command has not followed within 10 revolutions of the disc. For Group I commands if bit 2 is set to 1 the FDC will verify that the expected track has been reached after a 30ms delay. If an ID field with correct track number and CRC is not found within five disc revolutions a seek error is signalled. Bits 1 and 0 are used to select the track to track stepping rate.

For group II and III commands bit 2 if set to 1 adds a 30ms head settling delay before executing the command. Bits 1 and 0 are only used in write operations. If bit 1 is set to 0 it enables write pre-compensation in double density – a subtle alteration in the timing of the pulses recorded on the disc.

This is typically done when writing to the innermost tracks on the disc where the bit density is at a maximum, and it is done to reduce the likelihood of bit shift errors where the timing of a pulse is incorrect when being read back.

When writing a sector if bit 0 is set to 1 a deleted data as opposed to a normal data address mark is written. Note that unlike the operation of the 8271 read operations will always read all sectors, regardless of whether they are marked as deleted or not.

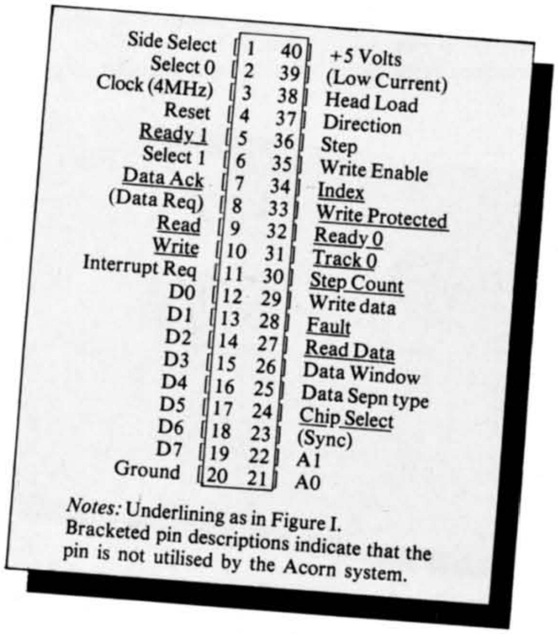
Whenever a command is completed an interrupt signal is generated on pin 28, and bit 0 of the status register is cleared. Thus the completion of a command can be recognised either by the CPU polling the status register or by the occurrence of an interrupt if the interrupt pin is connected to one of the two interrupt lines – NMI or IRQ – of the 6502 CPU.

However on my system it is not connected to either, so completion can only be recognised by constant polling of the status register until bit 0 is cleared.

The status register can be polled at any time to find the state of the FDC – see Table III for details. However to interpret the status it is necessary to know what the last command given to the FDC was, as some bits have two possible meanings. Care also needs to be taken if the register is constantly polled, as several of the status bits are reset whenever the register is read.

One area of significant difference

→



Notes: Underlining as in Figure I. Bracketed pin descriptions indicate that the pin is not utilised by the Acorn system.

Figure II: 8271 FDC pin configuration

From Page 105

between the two FDCs is in the approach to formatting discs. The 8271 requires five parameter bytes for each track written and then just the four ID field bytes as data for each sector written. The 8271 FDC automatically generates the sector and gap fill bytes as appropriate.

In stark contrast the 1770 FDC requires no parameters to tell it what inter-sector gap sizes and so on to use, but it does require the user to specify every single byte to be written to the disc – sector and gap fill bytes alike.

Thus only 40 data bytes have to be prepared to format a track using the 8271 FDC, but around 3125 bytes have to be prepared if using the 1770 FDC or 6250 if in double density mode. The appropriate data bytes to use with the 1770 FDC in single or double density are shown in Figures III and IV.

The bytes include the special address marks that have to be written at the start of each ID or data field, and also the Cyclic Redundancy Check (CRC) bytes at the end of each field which are added to enable the integrity of the data in each field to be checked.

To enable these special bytes to be specified data values between &F5 and &FF are reserved for signalling to the FDC the need to generate such bytes – see Table IV. The effect of this is that only data values of &00 to &F4 per byte can be written out when writing a complete track, either in the ID or data fields.

If other data values are to be written they can only be written sector by sector. Values between &F5 and &FF cannot be written in the ID fields.

Another important difference is that the 8271 controls the drive and side select signal on the interface to the disc drives. The 1770 has no facilities for controlling these signals, so some extra logic has to be added to the DFS board to provide them.

Also needed is an external signal to switch between single and double density, as this is not done via a software

Group	Command	Bits 76543210
1	Restore (seek track 0)	0000hvrr
1	Seek	0001hvrr
1	Step (in prev direction)	001uhvrr
1	Step in	010uhvrr
1	Step out	011uhvrr
2	Read sector	1000hs00
2	Read sectors	1001hs00
2	Write sector	1010hspd
2	Write sectors	1011hspd
3	Read address marks	1100hs00
3	Read track	1110hs00
3	Write track	1111hsp0
4	Reset	11010000
4	Interrupt on index	11010100
4	Force interrupt	11011000

Notes

d = 1 Write deleted data.
h = 1 Disable spin-up option.
p = 1 Disable write precompensation.
r r = 0 to 3 sets stepping rate of 6,12,20 or 30ms.
s = 1 Add 30ms settling time.
u = 1 Update track register.
v = 1 Enable track verify option.

When reading or writing multiple sectors the sector register is automatically incremented after each sector.

Table II: 1770 FDC commands

Bit	Name	Meaning
0	Busy	1 indicates the FDC is executing a command.
1	Index	Group 1 commands = index pin (pin 24).
	Data request	Write commands = data register empty.
	Data request	Read commands = data register full.
2	Track 0	Group 1 commands = track 0 pin (pin 23).
	Lost data	Data request not serviced in time.
3	CRC error	1 if CRC error detected – bit 4 set if in ID field.
4	Not found	1 if desired track or sector not found.
5	Spin-up	Group 1 commands =1 when spin up complete.
	Record type	Read data =1 if deleted data mark found.
6	Write protect	Write commands =1 if disc protected.
7	Motor on	=head load pin (pin 20).

Table III: Status register meanings

PROBLEM

COULD you please advise me as to whether it is possible to use an Atari Tracker Ball on the BBC Micro? – K.A. Goverd, Avon.

SOLVED

The Atari Track ball article in the January and February 1985 issues of* The Micro User *should tell you what you wish to know. Interface packs 19 and 20 are still available from Musbury Consultants (Pack 19 £18, Pack 20 £10, address on page 118). However the February 1985 issue also told how to perform the interfacing purely in software.

command to the FDC but by the presence or absence of a signal to pin 26 of the chip.

However this is relatively easy to arrange by adding a write-only latch register to control these extra signals, which is itself driven from the signals already present at the 8271 socket. At this socket two address lines – lines 0 and 1 are available.

In addition there is a Chip Select (CS) signal which is active whenever addresses between &FE80 and &FE9F are selected, and a data acknowledge signal which is active whenever addresses between &FE84-&FE87, &FE8C-&FE8F, &FE94-&FE97 or &FE9C-&FE9F are selected. On the 1770-based system that I use the latch is written to whenever the data acknowledge signal is present.

But beware, for unless the logic in your DFS is so arranged that a data acknowledge signal cancels the chip select signal to the FDC writing to &FE84 will be interpreted by the FDC as a command – that is, as if writing to &FE80 – as well as activating the separate latch register, for only four distinct addresses are actually available from the two address lines present.

On my system, which is not necessarily standard, writing to this latch register at &FE87 provides the necessary extra signals, with bit 0 and 1 controlling the drive and side select lines, and bit 2 controlling the density used by the FDC.

Not surprisingly there are some things that the 8271 can do which the 1770 cannot. For instance, the 8271 provides for many more alternative head load, head unload, head settle and track-to-track stepping times. It will also handle sectors with lengths of between 128 and 16384 bytes, whereas the 1770 will only handle sectors of up to 1024 bytes.

If these features are used as part of a software protection scheme then no amount of clever emulation of the 8271 commands will allow a 1770-based DFS to work. However virtually any other method of protection can be got round by intelligent use of the 1770's facilities.

Acorn has specified the standard method of communicating with the 1770 FDC via the DFS. Just as Osword Calls &7D, &7E and &7F were reserved for use with a 8271-based DFS, Osword calls &70, &71, &72 and &73 have been set aside for use with a 1770 based DFS. However description of these would themselves warrant a whole article, so it must be left to another time.

Data Byte	Single density	Double density
&F5	Not allowed.	Write &A1, with missing clock pulse between bits 3 and 4. Reset CRC.
&F6	Not allowed.	Write &C2, with missing clock pulse between bits 2 and 3.
&F7	Write 2 byte CRC.	Write 2 byte CRC.
&F8-&FB	Write data with clock pulse pattern=&C7. Reset CRC.	
&FC	Write data with clock pulse pattern=&D7.	
&FE	Write data with clock pulse pattern=&C7. Reset CRC.	

Table IV: Reserved data values when writing a track

Description	Value	No of bytes sent to FDC	Notes
Post Index Gap	&FF	40	
┌ *Repeat block 10 times*			
Sync. bytes	&00	6	
ID Address Mark	&FE	1	
Track number		1	
Side number		1	
Sector number		1	
Sector length	&01	1	
CRC	&F7	1	(2 bytes written to disc)
Post ID gap	&FF	11	
Sync. bytes	&00	6	
Data Address Mark	&FB	1	(&F8 if deleted)
Data		256	
CRC	&F7	1	(2 bytes written to disc)
Post Data Gap	&FF	10	
└ *Repeat block 10 times*			
Pre-index Gap	&FF	135 approx	

Figure III: Single density formatting

Description	Value	No of bytes sent to FDC	Notes
Post Index Gap	&FF	60	
┌ *Repeat block 16 times*			
Sync. bytes	&00	12	
Address Mark	&F5	3	(3*&A1 written to disc)
ID Mark	&FE	1	
Track number		1	
Side number		1	
Sector number		1	
Sector length	&01	1	
CRC	&F7	1	(2 bytes written to disc)
Post ID gap	&4E	22	
Sync. bytes	&00	12	
Address Mark	&F5	3	(3*&A1 written to disc)
Data Mark	&FB	1	(&F8 if deleted)
Data		256	
CRC	&F7	1	(2 bytes written to disc)
Post Data Gap	&4E	24	
└ *Repeat block 16 times*			
Pre-index Gap	&FF	668 approx	

Figure IV: Double density formatting

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NEWSLETTER

Help for the Boat People

MICROLINK is being used to bring hope to thousands of distressed Vietnam refugees living in the UK.

Their plight largely ignored, these former Boat People have become a forgotten multitude of have-nots crowded into substandard dwellings.

But now MicroLink's telex and electronic mail services are easing cases of hardship by speeding the reunification of families and smoothing their path into Western society.

Many former Boat People are suffering because when they arrived in Britain the authorities assumed that being Vietnam refugees they were automatically Vietnamese.

In fact three-quarters of them were ethnically Chinese, speaking only a form of Cantonese and unable to understand the Vietnamese instructors hired to teach them English.

But a Chinese Vietnamese Advice Centre staffed by voluntary social workers has been opened in London to help them, and it is using MicroLink in its efforts.

Alf Jackson, one of the volunteers, said: "MicroLink's facilities will enable us to establish better communications with refugee agencies all over the world – particularly Hong Kong – and put dispersed families in touch.

Spreading the good word

A MAJOR problem facing any new business is making people aware of its existence – quite a handicap when all its potential clients live overseas.

But thanks to the international flavour of MicroLink a recently started British venture is already known about as far away as Tokyo.

MicroLink subscribers Duncan and Rita Baker started a residential school in Lydbury, Shropshire, to teach English to foreigners.

Through MicroLink it came to the notice of another subscriber Kaz Hatakeyama, a Japanese journalist and television presenter, who featured it on his Tokyo TV show.

"As a result we've had eight inquiries from Japan already", said a delighted Duncan Baker who gave up his foreign office career to join his language teacher wife in starting the Lydbury English Centre which opened in June.

"Promoting our school abroad is very difficult. At the moment we are having to rely mainly on former colleagues and people we have met on our travels around the world.

"So far we have also had inquiries and bookings from six European countries, the Middle East, Korea and China.

"We are starting off with places for five overseas students at one time, but hope to soon build up to 10.

"Because businessmen in particular can often only take time off for language training at short notice the MicroLink telex facility is a fundamental aspect of our operations".

CLIFF IS STILL TOPS

DESPITE what some critics might say the top show in London is the Cliff Richard musical Time.

At least that's the verdict of MicroLink subscribers according to the volume of bookings placed through TheatreLink, which is operated in association with theatrical agency Edwards & Edwards.

Although Time has been panned by some of the critics it beats the long-running hit musical Cats into second place in the MicroLink theatre-goers' Top Ten. In third place comes Me And My Girl – another of the eight musicals in the popularity list – followed by 42nd Street, with Starlight Express in fifth place.

Another target for the critics, Mutiny!, comes sixth followed by perennial favourite thriller The Mousetrap and the comedy hit Run For Your Wife.

Les Miserables comes ninth and Chess, despite being Show of the Year with one million seats sold so far, surprisingly only just sneaks into last place.

YOUR chance to join MicroLink – turn to Page 75

Commonwealth link?

MICROLINK has been chosen as a potential medium of communication between the Commonwealth Secretariat in London and the organisation's 49 member countries.

A project is underway to assess various electronic mail and telex options in conjunction with the Secretariat's planned expansion of its computer facilities.

The aim is to improve the speed and efficiency of links between member countries and also with international bodies like the United Nations' agencies and the World Bank.

The Commonwealth's own specialist databases will also be set up as part of the project which is expected to be completed in two years.

"MicroLink is one of two systems we are experimenting with at the present time", said Commonwealth Secretariat computer manager Peter Windle. "We have been impressed by its user-friendliness and ease of use".

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Are your SAVEings really safe?

Don't bank on it unless you use JOE PRITCHARD's osfile Intercept

PROGRAM development on disc systems has one hazard which is not experienced with tape systems. That is it's possible to accidentally overwrite a file on the disc without meaning to when saving a program.

OK we can lock files, but this involves us in having to unlock files before we can overwrite them if we want to. The routine in this article supplies us with a way of preventing accidental overwrites, as well as showing how the behaviour of the DFS on the BBC Micro can be modified to your own requirements.

Once active – turning on the routine is done by calling PROCassemble or setting the vector involved to point to your own machine code – SAVE and *SAVE commands are treated in a different manner to that in which they are usually processed.

An attempt is made to open the file whose name is given in the filename of the SAVE command. If the file can be opened then the file exists and you are asked if you really want to overwrite the already existing file.

If the answer to this prompt is yes then the SAVE operation carries on. Otherwise, no further action is taken. If the file doesn't already exist then it's written to disc. LOAD, DELETE and so on are not affected.

The Break key has been programmed to set the vector up to point to the code again – I find this feature useful because I'm one of these misguided souls who use Break as an Escape key. Ctrl+Break will reset the vector.

Program I shows the machine code needed to add this facility. The operation of the code depends upon the fact that the important filing system routines in the BBC Micro are all vectored.

The address of a given routine is stored in a two byte location in page 2 and can be altered by the programmer to point to another piece of machine code which can either replace or enhance the normal behaviour of the operating system routine involved.

It's not just filing system routines that are vectored in this way – most other important OS routines are as well. When we call an OS routine, such as oswrch at &FFEE, the code at &FFEE instructs the CPU of the micro to execute the machine code pointed to by the contents of the oswrch vector, at &20E and &20F. This is simply because changes in the operating system can be made transparent to the user by the OS initialising the vectors to point to the correct routine in the OS ROM.

Provided we use the proper entry points, which will not be changed by Acorn, we can be sure that our code will run on different versions of the BBC OS. This interception of vectors is a powerful programming tool when used correctly, allowing us to significantly alter the behaviour of the OS of the computer.

This program simply intercepts the osfile vector, which deals with saving and loading blocks of data. There are other facilities offered by this routine as well, but we're just interested in catching the SAVE operations and letting all the others go on as usual.

Osfile is entered with A holding the code number of the operation to be performed and X and Y pointing to a parameter block for the operation. Further details can be obtained from the BBC Advanced User guide.

Line 220 checks for a SAVE operation, indicated by 0 in the A register.

If the operation is a SAVE the address of the filename is obtained from the parameter block passed to osfile – lines 270 to 320. An attempt is then made to open the file for input using osfind and if the routine returns with 0 in the accumulator then the file doesn't exist. A jump is made to *ok* to save the file.

Otherwise a prompt is printed out (lines 370 to 460) and a jump to *out* is made, where osrdch is used to read a character from the keyboard – lines 560 to 620. If Y or y is detected then a jump is made to *ok* where the file is written to disc, overwriting the old file.

Any other response will clear the stack up and execute an RTS to return to the calling program – in this case the Basic interpreter. Note the use of osfind to close all open files at lines 480 to 490 and 640 to 650.

The only other fancy code is at lines 700 to 730. Here we check for Escape being pressed, and if it is we acknowledge the fact by calling osbyte 126. ■

```
   10 REM Safer saving by
   20 REM intercepting OSFILE
   30 REM Joe Pritchard
   40 REM (c) The Micro User
   50 REM DISC ONLY
   60 :
   70 PROCassemble
   80 :
   90 END
  100 :
  110 DEFPROCassemble
  120 IF ?&212+256*?&213=&0A00 THEN E
NDPROC
  130 oswrch=&FFE3
  140 osbyte=&FFF4
  150 osrdch=&FFE0
  160 osfind=&FFCE
  170 oldvec=?&212+256*?&213
  180 FOR pass%=0 TO 2 STEP 2
  190 P%=&0A00
  200 [OPT pass%
  210 .newvec
  220 CMP #0:BNE notus
  230 PHP
  240 PHA
  250 TXA:PHA
  260 TYA:PHA
  270 STX &70:STY &71
  280 LDY #0
  290 LDA (&70),Y:PHA
  300 INY
  310 LDA (&70),Y:TAY
```

→

Program I

From Page 111

```
320 PLA:TAX
330 LDA #&40
340 JSR osfind
350 CMP #0
360 BEQ ok
370 LDA #message MOD 256:STA &70
380 LDA #message DIV 256:STA &71
390 LDY #0
400 .ploop
410 LDA (&70),Y
420 CMP #0
430 BEQ out
440 JSR oswrch
450 INY
460 JMP ploop
470 .ok
480 LDA #0:TAY
490 JSR osfind
500 PLA:TAY
510 PLA:TAX
520 PLA
530 PLP
540 .notus
550 JMP oldvec
560 .out
570 JSR osrdch
580 BCS error
590 CMP #ASC"Y"
600 BEQ ok
610 CMP #ASC"y"
620 BEQ ok
630 .done
640 LDA #0:TAY
650 JSR &FFCE
660 PLA:PLA
670 PLA:PLA
680 RTS
690 .error
700 CMP #27
710 BNE done
720 LDA #126
730 JSR osbyte
740 JMP done
750 .message
760 OPT FNequs("File exists. Overwr
ite the file?")
770 OPT FNequb(7)
780 OPT FNequb(13)
790 OPT FNequb(0)
800 ]
810 NEXT
820 *KEY 10 ?&212=0:?&213=&0A|M
830 ?&212=0
840 ?&213=&0A
850 ENDPROC
860 :
870 DEFFNequs(equs$)
880 $P%=equs$
890 P%=P%+LENequs$
900 =pass%
910 :
920 DEFFNequb(equb%)
930 ?P%=equb% MOD 256
940 P%=P%+1
950 =pass%
```

This listing is included in this month's cassette tape offer. See order form on Page 141.

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Monitor levels of radiation with a micro

MIKE COOK shows how to build your own geiger counter in Part 40 of his course

THIS is a project that I have wanted to do for some time. However until now, I have not undertaken it as I thought there would be insufficient interest.

Now, due to the unfortunate accident at the Chernobyl nuclear power station, interest in monitoring radiation levels is high, so let's see how we can turn our trusty BBC computer into a radiation monitor. If you are not familiar with the jargon of atomic and nuclear physics please read the panel on radiation on Page 116.

I first worked with radioactive isotopes when I left school. The company I worked for made level detectors for blast furnaces. Basically a beam of radiation is sent through the furnace and detected at the other side.

As the coke, limestone and iron ore that fill the furnace are not very dense the radiation passes straight through. As the iron is smelted from the ore the level of liquid iron rises inside the furnace. When the liquid iron reaches the radiation beam it absorbs the radiation, therefore nothing is detected and you know how full the furnace is.

The circuit presented here could be used for exactly the same purpose for those of you with a blast furnace in your back garden...

More useful however might be the experiments that can be performed as part of a course of study in physics.

The circuit could also be used to monitor changes in background radiation for those of you who do not believe the official figures, although I should stress that the measurements I have been taking show no cause for the slightest alarm.

There are many ways to detect ionising radiation, perhaps the simplest is with a piece of photographic film. This is the basis of the blue radiation monitoring badge worn by all regular workers with radioactive material.

Radiation will fog photographic film. The badge has a piece of film inside it and small areas are covered by varying thicknesses of aluminium.

When developed the degree of fogging under the various thicknesses of metal indicate the types of radiation and the dosage received over the time the badge has been worn.

As the film badges are sent away for processing every six months or so, they do not immediately indicate that an abnormal dose has been received. Immediate readings can be taken with a pocket dose meter which is basically a gold leaf electroscope.

A static charge is induced on two thin leaves of gold. As they have the same charge they repel each other and so are forced apart as shown in Figure I.

Radiation entering the chamber causes the air or gas to ionise and so conduct a small amount of charge off the gold leaves, hence they move closer together. The closer they are the more radiation there is about. This type of detector was used when radioactivity was first investigated.

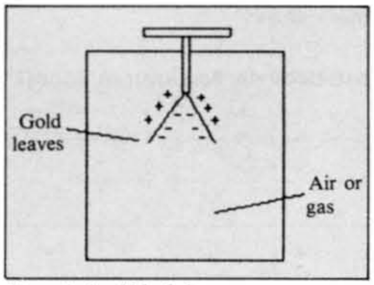

Figure I: A gold leaf electroscope

The radiation detector best known to the public is the Geiger counter. This works on the same principle as the electroscope – that of making some gas ionise and thus conduct electricity.

At the heart of a Geiger counter is the Geiger-Muller tube. This has two electrodes – one is simply a hollow conducting tube and the other a single wire running down the middle, as is shown in Figure II.

It is filled with a mixture of gasses and a voltage is placed across it. This voltage is normally in the range of 300 to 1500 volts and depends on the tube's geometry and the gas pressure and mixture.

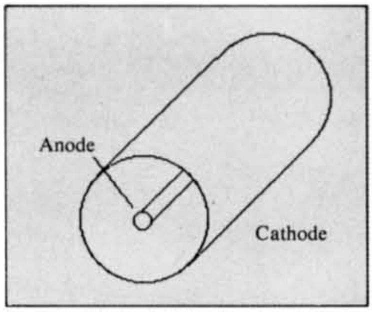

Figure II: A Geiger-Muller tube

What happens is that some radiation comes along and knocks an electron off an atom of the gas. This electron is then accelerated by the voltage across the tube towards the anode.

As it picks up speed it bumps into other atoms of gas knocking out more electrons. These extra electrons are also accelerated and are involved in further collisions.

The net effect is that the tube becomes a virtual short circuit and so the voltage across it collapses. When this happens there is no longer any voltage to accelerate the electrons, so the tube stops conducting and a voltage can develop across it again.

The overall effect of all this is that if we measure the current through a Geiger-Muller tube we will see a pulse for every radioactive ionisation event which occurs in the tube.

Some of the gases in the tube are used to mop up the positive ions left behind by the electrons and quench the tube – this is normally done with a halogen. During this quenching time the tube can not detect any radiation and so we call this the dead time of the tube.

The dead time is normally in the order

THE BEEB BODY BUILDING COURSE

of a few tens of micro seconds and, as we shall see later, we can compensate for any counts missed due to the dead time.

The voltage characteristic of a Geiger-Muller is shown in Figure III. It takes a certain voltage before any radiation is detected, then if you put more voltage across the tube you will get a higher count as the tube is more sensitive.

There is a plateau region where the count is essentially independent of voltage and, finally, the count increases towards continuous discharge. The ideal operating voltage is in the middle of the plateau.

What a Geiger-Muller tube can't tell you is what sort of radiation caused the initial ionisation. To do this you need to use a scintillation counter. These work by making the radiation cause a small flash of light in a crystal and then amplifying the light.

From the distribution of the brightness of the flashes you can get the signature of the isotope and its radiation. Unfortunately scintillation detectors cost several hundred pounds.

Therefore for our radiation monitor we will use a Geiger-Muller tube as these give adequate results at reasonable cost. Geiger-Muller tubes come in all sorts of shapes and sizes with the tube voltage being the major variant, but they can all be driven by a similar circuit.

However for this month's project I have narrowed down the field to a choice of two. The first is the cheapest I could find. It is called the ZP 1300 and made by Mullard.

Due to its price it does not look all that impressive, being a small glass tube 15mm long and 6mm in diameter. It looks rather like a neon lamp. However at one end is a cathode strap that can be soldered directly into the circuit.

To prevent heat damage solder it at the very end of the strap. The anode connection is made via a clip. No attempt must be made to solder the anode on directly, otherwise damage will certainly occur.

This tube has a sensitive length of eight mm and is filled with helium, neon and halogen. It is sensitive to gamma rays and also high energy beta particles – >0.5MeV. This is perfectly adequate for measuring background radiation even though it will not detect the lower energy beta particles nor alpha particles.

To do this you need a tube with a very thin window. This is provided by the second tube on offer – the ZP 1401, also made by Mullard. This is about twice the price of the ZP 1300 but is the cheapest tube in the range which will detect all three types of radiation.

This tube is 43mm long with a 9mm diameter end window of mica which allows weak radiation to enter the tube. Care must be taken not to touch this end window as it will damage it.

To protect against this there is a thin plastic grating over the front of the tube. The sensitive length is 39mm and is filled with neon, argon and halogen. Just like the ZP 1300 it has a cathode strap and anode clip.

Some people are worried about X-ray emission from monitors and TV sets. This is so low that it is very difficult to detect. Geiger-Muller tubes sensitive to X-rays are available but they need some 1600V and cost over £150.

To detect any radiation we must place the correct voltage across the Geiger-Muller tube. In the case of the ZP 1300 this is 550V and for the ZP 1401 it is 500V. As they have plateau lengths of 100V and 200V this is not critical and both tubes could be run at the same voltage.

There are various methods of generating such a high voltage. My main criteria was to produce the high voltage at as low a cost as possible using standard components.

The basic idea is to use a standard transformer backwards. If you take a standard low voltage transformer and feed a low voltage signal into it you will get mains voltage out of it. So basically what we are doing is to pull current through a transformer. This sets up a magnetic field that induces a voltage in the other winding.

When you stop the current flowing the field collapses like an elastic band snapping back and an opposite voltage is induced in the other winding. If you do this rapidly enough you can rectify and smooth the induced voltage and get a voltage step-up effect.

If you do this current switching too fast there will not be enough time to let the magnetic field build up and so the step-up will be less. Therefore by altering the speed of switching you can alter the voltage output from the transformer.

This is shown in Figure IV along with the rest of the circuitry required for the radiation detector. Transistor T1 is switched by bit 7 of the user port. We can use timer 1 in the free run mode to produce a continuous square wave at this pin.

The period of the square wave is determined by the value in timer 1's latches. Therefore by altering this value you can change the output voltage to suit other tubes. I managed to produce a maximum of 650V from my prototype, so it should be suitable for both types.

I used a transformer with a 3V secondary – in fact it was a 3-0-3

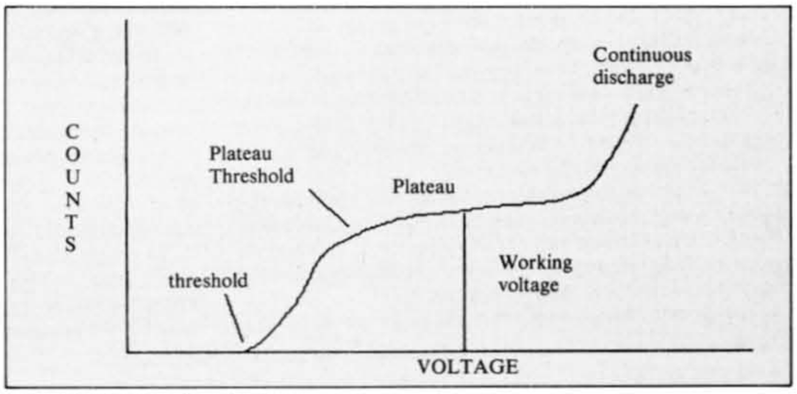

Figure III: Geiger-Muller tube characteristics

What IS radioactivity?

THE BEEB BODY BUILDING COURSE

IN order to understand what is meant by radioactivity we must first understand something about atoms. Basically three different particles make up an atom – electrons, protons and neutrons.

These are arranged with the protons and neutrons clustered in the centre or nucleus of an atom with the electrons surrounding them. The feature which differentiates atoms into different elements is the number of electrons surrounding the nucleus – all the properties of an element are determined by the number of electrons.

For each electron surrounding the nucleus there is a proton in the nucleus because electrons and protons carry equal and opposite charges and so balance each other. Neutrons carry no charge, but act to bind the protons together. There is an optimum number of neutrons needed to bind together any given number of protons, but in practice there can be more or less neutrons than the optimum.

When this happens we say we have an isotope. Isotopes have exactly the same properties as a normal atom except that, having a different number of neutrons, they weigh a little bit more or less.

Some naturally occurring isotopes are radioactive, but it is also possible to make them artificially. The alchemist's dream of turning base metal into gold was achieved in the thirties in a Cambridge laboratory. Simply take a little mercury, bash it about a bit until you dislodge a proton and an electron and you are left with an atom of gold. Unfortunately it is much cheaper to dig out of the ground than to make it an atom at a time.

How do we bash an atom about? Basically we shoot electrons, protons and neutrons into the substance and hope to chip some bits off the atom. When we do chip a bit off the resulting atom is usually unstable, as it contains too much energy for its own good. In time it releases this energy and it is this release that we call radioactivity.

There are three major types of radioactive emission. Alpha particles are made from two neutrons and two protons. In atomic terms this is a very heavy particle. Beta particles are simply electrons which have been ejected from their atoms. Finally gamma rays are powerful bursts of electromagnetic radiation.

The energy of a particle or a wave can be thought of as being rather like its speed – the more energy it has, the further it can travel. This is important when we consider the effects of radiation. What happens is that the alpha, beta or gamma radiation travels along knocking into atoms and breaking bits off them. If it dislodges an electron we say that the atom has been ionised, so we speak of this sort of radiation being ionising radiation.

Each type has its own characteristics. The alpha particle is very heavily ionising, blundering along like a cannon ball. Luckily it can't travel very far in air before all its energy is used up. It has a range of only a few centimetres and won't even pass through a piece of paper.

On the other hand gamma rays can penetrate the earth to a depth of several miles, but fortunately they do not do nearly so much damage.

In the middle come beta particles. Depending on their energy you can stop them with a few inches to a foot of lead. They are more ionising than gammas, but not nearly so much as alphas.

So how harmful is radiation? The safest amount would be nil, but this is impossible to achieve as it is all around us. This background radiation comes mainly from natural radioactive isotopes in the soil and rocks and from cosmic rays from the sun. There are even some naturally occurring radioactive isotopes in our own bodies, so we are constantly getting dosed from within.

What ionising radiation does is to ionise the fluid that makes up cells and upset their chemical balance. The result is that the cell dies. Normally this is of little consequence as your body continually replaces cells. The difficulty comes when a lot of cells are killed off at once with a large dose of radiation. As your body can't replace them quickly enough shorter bursts.

You are also in trouble if non-replaceable cells are destroyed such as the germ cells in the ovary or brain cells. At lower dosage levels a cell is not killed but can become damaged, leading to changes in the characteristics of the cell. This can reduce growth, produce cancerous cells or produce genetic mutations.

What level can we consider safe? Basically if you are working in an industry concerned with radioactivity you are allowed to get a higher dose than a normal member of the public.

Dosage is measured in rads, which stands for Radiation Absorbed Dose and is a measure of the amount of energy absorbed from radiation. At low levels it matters not that the dose was received slowly over several years or quickly in shorter bursts. In calculating the amount of radiation that can be received the rem is used.

A rem is simply the dose in rads multiplied by an ionising factor dependent on the type of radiation. This would be 10 for alpha particles and one for nearly everything else. The maximum dose can be calculated from the age of a worker and it given by D=5*(age-18) rems.

This is simply an empirical formula, but it shows that a 30-year-old could have accumulated a maximum dosage of 60 rems if he started work at the age of 18.

At retirement he could have received 235 rems and providing the rate was not greater than three per 13 weeks it is considered that there is a negligible probability of any damage being caused.

For people who don't work in the nuclear industry the safe dosage has been set at 50 mrems – milli rems – per year. Compare this with the normal background dose averaged over the whole UK of about 100 mrems per year.

So a safe dosage is deemed to be about half the natural level found in this country. In other countries natural radiation can be very much higher. For example, in Rio de Janeiro the background dose is 1,000 mrem per year.

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From Page 115

winding so I used only one side and left the other unconnected. To get the step-up to be greater than the 240V of mains the winding is connected to the 12V auxiliary power supply of the computer. The circuit draws negligible current, so you can continue to use it for other purposes.

Having got the high voltage it is rectified and smoothed by a high working voltage diode and capacitor. The values of resistors around the Geiger-Muller tube are different for each tube and follow the manufacturer's recommendations.

Any pulse from the tube is capacitively coupled into a transistor and clamped by the diodes D2 and D3. This clamping prevents the transistor being subject to large voltages. The transistor then feeds its signal into bit 6 of the user port.

All the parts, including a printed circuit board, can be purchased as Body Build Pack 34. As you will see from the panel below you can get the tube and the rest of the circuitry separately.

This allows you to choose the tube you want. Note also that you will need to have a user port cable. This is the one we always use and is sold as Body Build pack No. 2.

Bit 6 of the user port can be used to decrement timer 2 when it is acting as a counter. By decrementing the hardware counter in the VIA you make sure that you see all the pulses produced by the Geiger-Muller tube.

Another alternative would be to make the pulse produce an interrupt. However, there is a danger of missing a pulse as the interrupts are not always serviced immediately.

The software needed to drive this circuit is basically very simple. An example is given in Program I.

First of all you need to set timer 1 going at a rate to generate the correct voltage for the tube. Then you need to set up timer 2 as a counter clocked from bit 6 of the user port. All you need to do now is sit in a loop periodically sampling the value in the counter and subtracting it from what you had last time – remember the timer counts down. Using the computer's internal clock you can collect the number of counts in a minute and display the result.

You could write a more complex program which would give you the count averaged over the last hour updated every minute. Or you could plot the count rate on a graph and store the values on disc for later processing.

You can correct for the dead time of the Geiger-Muller tube by using the formula: True Rate=Observed Rate (1-Observed Rate*Dead Time). On the low rates of background counting this correction will give a negligible change.

Background radiation occurs randomly, so this means that there may be sudden bursts of activity and equally sudden lulls.

Try placing a luminous clock or watch next to the tube and you can see the count rate increase. This is more obvious if you use older ones as the modern ones emit low energy beta particles that are harder to detect.

Relating count rate to dose rate is not easy as to be really accurate you must know what sort of radiation you are measuring. Each tube will be supplied with a copy of the manufacturer's calibration curve.

To give you some idea a count of 10 per second will indicate a dose of 2 mrads per hour with the ZP 1401 and 25 mrads per hour with the ZP 1300 tube.

These figures are based on a Cerium 137 isotope which is a gamma emitter. This relationship between count and dose rate is logarithmic, so beware of extrapolating the figures.

● *So there you have it, radiation detection by your own fireside. Unfortunately in the event of a nuclear war the whole thing won't work because the mains will be out, but I'm working on that one. Hopefully I'll see you next month.*

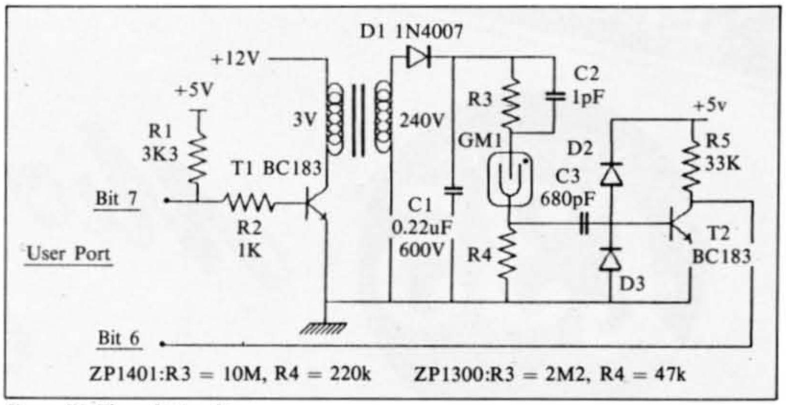

Figure IV: The radiation detector

Body Build Pack 34: Pack 34a ZP 1300 Geiger-Muller tube £27.
Pack 34c ZP 1401 Geiger-Muller tube £52.
Pack 34c Electronic components to make Figure IV £15.
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```
   10MODE 7
   20PRINT"BEEB BODY BUILDING COURSE"
   30PRINT"RADIATION MONITOR"
   40PRINT"By Mike Cook"
   50?&FE6B=&E0 : REM ENABLE TIMERS
   60?&FE66=00
   70!&FE64=0
   80?&FE66=127 :REM THIS GIVES 550V
 USE 110 FOR 500V
   90REM THIS SETS SPEED OF T1
  100C%=0
  110REF%=!&FE68 AND &FFFF
  120TIME=0
  130ARMIGEDON=FALSE
  140REPEAT
  150REPEAT
  160T1%=!&FE68 AND &FFFF
  170T%=REF%-T1%
  180IF T% > &8000 THEN T%=&FFFF-T%
  190IF T% THEN C%=C%+T%:PROC_CLICK
  200REF%=T1%
  210UNTIL TIME > 6000
  220TIME=0
  230PRINT TAB(0,10);"Count is ";C%;"
 Per min";SPC(8)
  240C%=0
  250UNTIL ARMAGEDDON
  260DEF PROC_CLICK
  270SOUND 1,-15,1,1
  280ENDPROC
```

Program I

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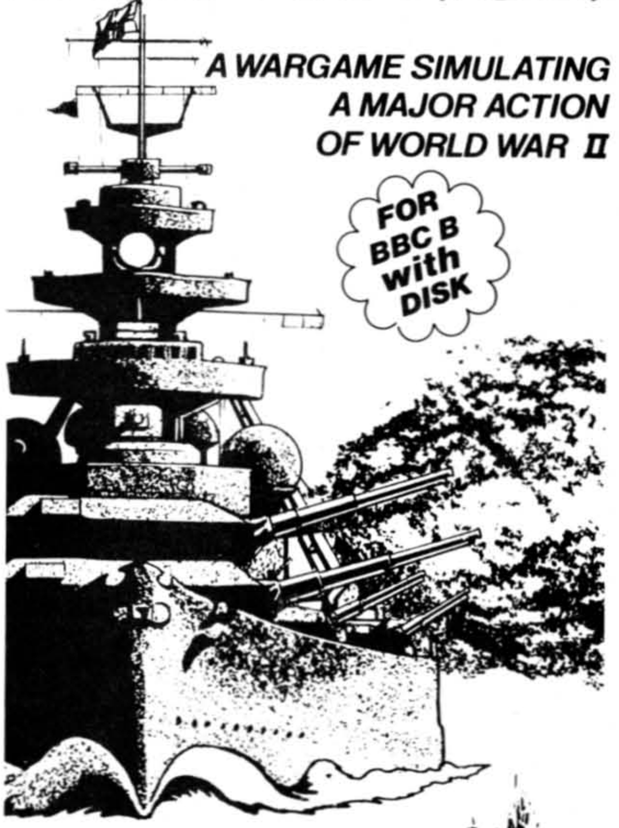

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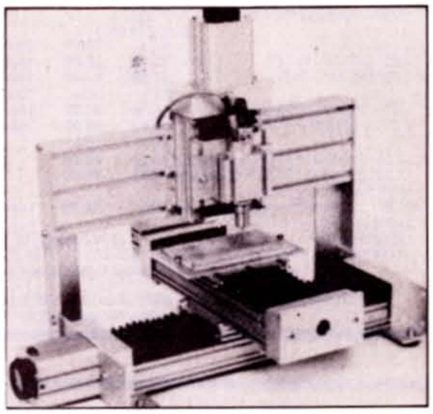

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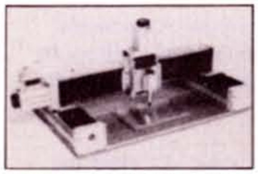

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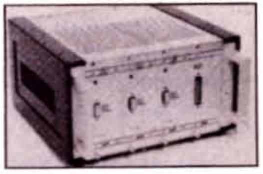

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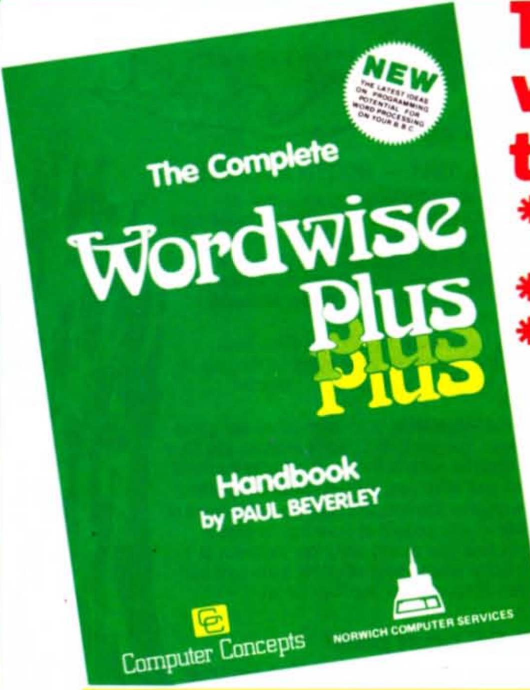

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£10 Prize letter

Sharing Superior's most intimate secrets

HERE are some tips on two Superior Software games – Repton 2 and Space Pilot.

On Repton 2 there is a place where over 500 diamonds are all in one block. When you start you are below some skulls. Move left slightly then down a little way and keep moving left until you see the edge of the screen.

There are two transporters, one high up and the other down near the bottom. Find a way to go into the top one. You will find yourself in a place with blue earth. Head for the top left corner.

When you are in the top left hand place a boulder will fall and you will not be able to get out. That is correct because you take the transporter just there. You will now be in a place with green earth.

Move horizontally right until you get to a small group of boulders and diamonds. Move through that and go to the room very near there, which has a transporter in it. Enter the transporter and you will find yourself in a place with blue earth.

Beware – a blind spirit has been let out. Get the key and then move as far right as you can and then down to get the diamond which unblocks the cage.

Move away and although you will hear a ping before you see the blind spirit it will go to the cage. Collect the diamond and keep going down and you will find yourself in a room with 500 diamonds in it.

When you have collected them all go to the bottom left hand corner and make your way through this new bit to the bottom right corner.

Go down and collect a puzzle piece and keep moving left until you come to a row of transporters. One of these will be higher than the others. Do not take this one yet.

Take the others and you will find that you have moved nowhere. Keep going until you get to the end of the row. Then take the one that is slightly higher than the others and you find yourself on the starting screen.

Here is my tip on Superior Software's Space Pilot: The idea of the game is to shoot planes until a big plane or airship appears.

Having shot this a couple of times you will be transported to another year or level which has different planes.

You can transport yourself automatically by pressing f0 then with your finger still on f0 press and relase escape, and finally let go ot the f0 key. – **Jonathon Cullen, Tonbridge, Kent.**

Win a tenner

● *Want to write to Micromail? The address is: Micromail, The Micro User, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY. Writers of the three most interesting letters will each receive a £10 prize.*

Exchange solution

THE problem of exchanging fields without using an intermediate field, raised by P. McDonald in the July edition of The Micro User, *was solved several years ago.*

Assembler language programmers have for a long time exchanged fields by using three consecutive "exclusive or" statements.

This technique is also available in high level languages, such as PL/I, that recognise bit strings.

It can be illustrated in Basic by the three statements.

```
X% = X% EOR Y%
Y% = X% EOR Y%
X% = X% EOR Y%
```

Note that the statements are identical, with the exception of the receiving field. Unfortunately for BBC Micro users it will only work on integer fields.

Floating point numbers are converted to integers before performing the EOR operation and so any decimal places are lost.

It will not work at all for character strings, even if they are the same length.

There is no logical reason why the interpreter should not perform correctly against all three types of field. The design of the interpreter just seems to be unnecessarily restrictive.

There is also no reason why an assembler subroutine could not be used, but it seems an awful lot of trouble just to avoid using an intermediate field.

If anyone knows of a way that this technique can be fully implemented in Basic I would be most interested. – **Don Bowman, Cranfield, Bedford.**

Do single discs double-up?

I HAVE a double sided 80 track disc drive and have always bought double sided discs for it.

The other day a friend said that a shop had told him that this was not necessary as all discs were double sided.

I therefore put a single sided disc in and programmed to format side 2, and it did so successfully. Will this work OK or will there be problems with it? Is there any difference between a single and double sided disc?

I have a BBC B computer with a Watford DFS. When I format a disc it asks if I want a large file – 62 files. I have read that the BBC can only handle 31 files, so what happens if I format for 62 files? – **F. W. Luckman, Western Park, Leicester.**

● All discs start life as high quality double sided discs. They are then tested and rejected, ending up with the appropriate labelling.

This means a single sided disc will probably work as double sided, but may have a noticeable fault on side B.

If it formats and verifies OK on your system it should be suitable.

It is the Acorn DFS that handles 31 files. The BBC Micro can handle as many files as the DFS will allow – up to 62 with a Watford DFS.

Home truths about Astrid

I WOULD like to make a few comments about Mike Cook's article on the Astrid satellite system in the June 1986 Hardware Review.

Firstly, now included with each Astrid system are the channel identification and calibration equations, complete with status point information for both satellites – that is the look-up tables.

Uosat 1 is now transmitting pictures on a regular schedule one day a week. A major problem with the picture quality was caused by the fact that the satellite is tumbling, thus blurring the image.

The pictures are transmitted at 1200 baud so Astrid is an ideal receiving system for them.

Note that additional hardware or software is required to display them as they are obviously not sent as standard

From Page 121

Ascii. Secondly if it is necessary to operate Astrid in a noisy environment Mike Cook is quite correct in stating that the simple aerial provided is not adequate and some form of directional aerial is needed.

I have designed a new aerial that is directional in that it will not receive interference signals from around or below it, but will receive any signals from up above. Thus it will not have to be pointed at the satellites as they pass over.

Thirdly, I noticed that very little information was given about the news bulletins and diaries transmitted by the satellites.

These are extremely interesting and give much information about weather satellites, shuttle launches, frequencies used and orbital parameters – in other words general scientific satellite news, as well as full information on the Uosats themselves.

Finally I would like to say I found the article very well written, giving a good account of the Uosat activity. – **Stephen R Webb, Astrid designer.**

Your rights on writing

WITH an increasing number of programs on the market designed to help the would-be programmer write games, the question that surely must be asked is how useful are these programs?

Incentive I see has just launched a new graphics adventure creator and there are other text-only creators on the market.

Graphics packages, painters and aids of all descriptions abound. There isn't a shortage of sprite designers and the like.

I'm sure some really amazing screens, games and effects can be produced with the aid of these, but at what point does your own program become a mere compilation of bits and pieces of other people's software?

Having written your game on a games designer or creator are you still free to sell, give or do what you like with your program? Even if you've only just borrowed those two lines necessary to reproduce the screen that you've spent two hours in designing is the program no longer all your own work.

There isn't much point in writing games for yourself. By the time you've written and debugged the program you've probably had enough of it.

So just at what point are you infringing upon someone else's copyright and to what extent have they permitted you to do this when they sold you the program? – **M.S. Ward, Hampton, Middlesex.**

● The software you write using one of these packages can usually be sold, but not always without cost.

In the case of the Incentive package that you mention the manufacturers say that the adventure you write is your own work, but obviously common courtesy demands that you acknowledge Incentive within your masterpiece.

A lot of other software development packages fall into this category, and you should check the appropriate manual for details.

Sometimes you may find that the author will require you to seek permission to sell his necessary code along with yours, but still no charge is made.

Finally some packages insist that if you use them a fee is paid. This may be a one-off payment, or a royalty depending on the number sold.

The simple rule is check with the manual of the software you are using to develop your program, and if that is not clear check with the manufacturers.

True path to Citadel

SEVERAL people have written to your magazine with hints about playing my game Citadel, and Rohan Smith's guide in the June 1986 issue of The Micro User *is very good.*

However there are a few things I would like to point out.

Several players think that to get into the Central Tower you have to jump off the East Tower, get killed and then move left to reach the switch.

The first time I heard about that trick I was rather surprised as I had thought it was impossible to reach the switch like that. It is a rather crazy method to use, so here is how it should be done:

First get the bucket and fill it with water from the Cellar or the Ocean, then go to the East Fireplace and put out the fire.

Climb up the chimney and you can now throw the switch that activates the lift to the left of the Central Tower.

It is with purpose I have made it possible to jump on to the title screen – I just did not think anybody would discover that trick.

The pink and the green objects are bones and are used to make a real age potion in the master cauldron – the witch doesn't appreciate this.

The small cyan things are pieces of iron and if you bring them to Stonehenge they are transformed into gold and you are given an energy reward.

I am sure that a lot of people find the game quite difficult, so I'll tell you how to activate a built-in help routine.

There are 10 green energy flasks worth 30 units, and 6 red flasks worth 50 units. The energy was intended for the invasion force and has been brewed by the witch in the master cauldron.

To get more energy LOAD the Basic loader program Citadel and type 8250!&85=&17192329 then run it.

When the game has loaded all the flasks will give you 65 units, so you'll have 440 more energy units to play with.

Along with friends I am currently working on a new game which is very different from Citadel.

It features some Greek graphics with temples, statues, trees, fountains, lakes, clouds and so on, and it should be released in a few months. – **Michael Jakobsen, Viborg, Denmark – author of Citadel.**

Knightlore laid bare

£10 Prize letter

I AM an avid Ultimate games collector and would like to share eight tips about one of my favourite games, Knightlore.

Nearly all balls home-in on unsuspecting werewolfs, but if you are a man most of them run away.

Some jumps are too high or too long for man or werewolf to jump, so walk to the edge of the object being jumped from, drop a charm, walk to the edge of the charm and press Shift + A almost simultaneously. The ghosts are impartial who they kill – so if you meet one make a speedy exit.

The wizard Melkhior may look a fairly docile fellow, but touch him and you are dead.

It is also a fairly bad idea to go into the wizard's chamber when you are a werewolf because he sends a deadly spell at you from his cauldron. In this game time is the essence, so don't hang around trying to collect the one charm. Know where it is if you need it.

Only two charms can be deposited in one room, so if you wish to jump as described earlier make sure there is less than two charms in the room.

Some rooms are duplicates, so if an object is hidden under vanishing blocks be careful because you might get a nasty surprise instead of an object.

Stephen Trombala, Stirlingshire.

Y prefix Mega Rom

THE June 1986 issue of The Micro User *contained a favourable review of the Mega Rom by Chalice Software. The reviewer states however that it does not allow a prefix letter before its commands.*

In these days of overcrowded ROM boards a prefix is important if users are to be able to easily access duplicated ROM commands.

The Mega Rom has an excellent set of facilities to switch on and off ROMS, including the ability to send commands directly to any particular Rom, so this omission would not be critical.

However, in common with our other rom – based products it does in fact allow a prefix – the letter Y can be used before any Mega Rom command to help prevent clashes. – **Martin Walker, Marketing Manager, Chalice Software.**

Sequencer for band

I AM thinking of getting a sequencer to be used for a small amateur rock band, and as I already have a BBC B, Acorn DFS, 80/40 double sided disc drive and access to a printer I was considering the Acorn Music 500.

However after reading various reviews there are still some points I would like cleared up if possible.

Firstly I understand that although it is not Midi compatible it does pass on the 1MHz bus, which I suppose is a likely candidate for a Midi add-on.

Is this possible? Can you put a Midi adapter onto the 1MHz bus at the back of the Music 500?

Will any software needed for this adapter get in the way of Ample, Music 500's language? And where can I get hold of a

→

Just a case of swapping

£10 Prize letter

WORDWISE has a very handy operator, Ctrl+S, which reverses the case of the letter at the cursor.

Program I will do the same when copying lines during program editing, and is particularly useful when editing programs with a lot of text. It also works for normal keyboard entry.

All you have to do is hold down function key 0 then press Copy, and the next character will be changed from upper case to lower case or vice versa.

It works by intercepting the Read Character routine – osrdch – and testing to see if the function key is pressed.

When two keys are held down the value of the first key pressed is stored in memory at address &ED.

This address is checked in lines 100 and 110, then the appropriate action is taken according to the character value. The carry flag must be preserved – lines 90 and 240 – since it is later used by the operating system.

*If you want to use a different function key the values are – f0 &A0, f1 &F1, f2 &F2, f3 &F3, f4 &94, f5 &F4, f6 &F5, f7 &96, f8 &F6, f9 &F7. (Note that the function key being used must always be blank – for example, *Key 0 should be typed in before using the facility.)*

Program II operates in much the same manner, but in this case all input is converted into upper case at all times – in other words no function key required.

This means that for use with children or people unfamiliar with computers the Shift key can be ignored for text input, and keywords will always be in upper case. This is a less comprehensive but similar effect to Julian Rockey's program in July 1986 Micromail.

Both programs only affect alphabet letters to avoid problems with numbers, arithmetic symbols and soon.

Run either program before you start work. Pressing Break will reset the system, so if you then later need the facility it can be restored by typing ?&210=&70:?&211=0.

This assumes that the code is assembled at &70 – for other assembly addresses amend accordingly.

– **Peter Vasey, Tyne & Wear.**

```
   10 REM REVERSER
   20 :
   30 readchar=!&210 AND &F
FFF
   40 FOR A%=0 TO 3 STEP 3
   50 P%=&70
   60 [OPTA%
   70 .ucase
   80 JSRreadchar
   90 PHP           \ Save
carry flag.
  100 CMP#97        \ "a" o
r greater?
  110 BCCnochange   \ If no
t, exit.
  120 CMP#123       \ Great
er than "z"?
  130 BNEnochange   \ If so
 exit.
  140 AND#223       \ Chang
e lower to
  150 .nochange     \ UPPER
 and exit.
  160 PLP           \ Resto
re carry flag.
  170 RTS
  180 ]
  190 NEXT
  200 ?&210=ucase
  210 ?&211=ucase DIV 256
```

Program I

```
   10 REM REVERSER
   20 :
   30 readchar=!&210 AND &F
FFF
   40 FOR A%=0 TO 3 STEP 3
   50 P%=&70
   60 [OPTA%
   70 .reverse
   80 JSRreadchar
   90 PHP           \ Save
carry flag.
  100 LDX&ED        \ Is fu
nction key 0
  110 CPX#&A0       \ held
dowi?
  120 BNEnochange   \ If no
t, exit.
  130 CMP#65        \ "A" o
r greater?
  140 BCCnochange   \ If no
t, exit.
  150 CMP#91        \ Great
er than "Z"?
  160 BCSlowercase  \ If so
, try lower.
  170 ORA#32        \ Chang
e UPPER to
  180 BNEnochange   \ lower
 and exit.
  190 .lowercase
  200 CMP#123       \ Great
er than "z"?
  210 BCSnochange   \ If so
, exit.
  220 AND#223       \ Chang
e lower to
  230 .nochange     \ UPPER
 and exit.
  240 PLP           \ Resto
re carry flag.
  250 RTS
  260 ]
  270 NEXT
  280 ?&210=reverse
  290 ?&211=reverse DIV 256
```

Program II

MICROMAIL

From Page 123

Midi adapter, or will a home–made one like that described in the March issue of Everyday Electronics and Electronics Monthly do?

Can you confirm or deny that Acorn will launch a souped–up version or even an upgrade? (Is this why they have lowered the price?) – **Henry Bloomfield, South Putney, London.**

● First, Acorn Music 500 is not a sequencer. A sequencer makes no sound of its own, whereas the Music 500 produces a vast range of different sounds under the control of Ample.

Secondly, if you are a programmer you could write your own Midi interface without an inordinate amount of work.

Such an interface can be made to have a meaningful dialogue with Ample, since Ample has calls to send sounds in response to numeric information.

But I'm afraid that simply sticking a Midi adapter, home–made or not, onto the 1MHz bus will not work. The Music 500 is not as it stands Midi–compatible.

Thirdly, you are quite right in supposing that the price drop is linked to forthcoming upgrades. One of these, the Music 200 – a Midi interface, is at present undergoing field trials.

Hybrid Technology – who produce the Music 500, and who are working on a pretty sophisticated new version of it – hope to have it on sale during the summer. But no release date has been fixed.

In the meantime take advantage anyway of the price of the standard Music 500. It's now a real bargain.

Gabriel Jacobs

Possible or impossible?

ACORN'S reputation for customer support deserves to get worse. I wrote on 3.3.86 for advice on whether highlight codes could be used with the Viewstore label utility.

They replied on 14.5.86 to say "it is not possible" and on 15.5.85 to say that "there is no reason why you cannot use highlight codes with the label utility".

Both letters came from the same individual – who gave no advice on how to use the codes.

The correspondence reminds me of the reply given by Jimmy Carter when asked if he had felled a cherry tree: "Father, I cannot tell a lie. Maybe I did and maybe I didn't". – **T Turner, London, SE10**

● Can any of our readers help?

Preventing the printer from hanging

I ENJOY writing programs and like to make them as user friendly as possible.

I find it anoying to have to press Escape as the computer "hangs" because no printer is

Confessions of a faint-hearted Micro User

Mixing of Masters and masters

Dear Trev,

How does life get so complicated? Why is it that things get so mixed up instead of simpler? I asked Clive and he said it was entropy but I don't see what a French holiday resort has to do with it.

And why does Andrea insist on getting more like Andrea as the years go on? I thought she might mellow in her declining years – "No, not tonight, Bob" – but I was wrong. Which explains why I spend so much time seeking solace at the Ram and Buffer. "It'sh not so lace, let's have another".

Which philosopher was it that said the answer to life could be found written on the bottom of a pint of Boddingtons? I think he was drunk at the time and so was I when Nemesis – no it's not a new Level 9 adventure – appeared in the form of Doreen.

It was at an extraordinary meeting of the Model A Appreciation Society, a specialised subgroup of the Rogues, membership by invitation only. Buy a round and you're invited.

We were all sitting round discussing Great Bugs I Have Known – other people's, not our own – mourning the demise of the cassette fix and generally bragging about programs we're writing – whose listings we'd bring next time – when in walked Clive. With a woman.

"Just the man we were looking for", he cried with a look on his face like an Electron owner who's just been given a BBC Micro. "Bob meet Doreen".

At this point I should have made my excuses and left, as they say. Don't they have expense accounts on the News of the World? However one look at Doreen and I felt I had to ask permission to leave the room. She has that sort of effect.

It turned out that she's a teacher from the local El Alamein Comprehensive, known to all in Romchester as Dunkirk. It's the sort of place they used to send kamikaze pilots to toughen them up and make the last flight look so much more attractive.

Anyway all I know is that at the mention of the name Alan – who teaches chemistry there, in the hope that one day "the little swine will blow themselves up" – started giggling hysterically, muttering "We shall fight them in the classrooms and on the playing fields..." in a frighteningly realistic Churchillian manner.

"Pull yourself together man", Doreen snapped, casually catching him across the face with the back of her hand. "You", she said looking at me in a way that reminded me of the national service I never did. "Clive tells me that you've got the sort of experience I want".

My mind went numb, remembering the time Clive and I had gone to the Micro User show and met the nice little girl from the Soft Centre who down there was selling software. I can never read about new educational programs for biology without cringing. Happily Clive hadn't blabbed but the truth was far, far worse.

"I'm a needlework and karate teacher so I've been put in charge of teaching computing. And next term we're getting some new Masters and you apparently know all about them".

"I don't know any teachers", I lied desperately, wishing I'd never met this one. Sometimes I can see the future with dreadful clarity. Did you know I'm clairvoyant? Women see right through me.

"Not schoolmasters, BBC Masters, moron", she replied in a way that reminded me horribly of someone. At the time I couldn't think who, but on reflection the expression on her face rang a bell.

"Clive here tells me that you know them. Intimately". Actually Clive wasn't there. He'd escaped muttering about a backup program he couldn't copy...

All the time she was saying this she was staring at my "Micro Users do it bent over" and "Master 128 is a rude word" badges in a very unsettling way.

"But I haven't got a Master anymore".

"I have", she said, looking at me most disconcertingly. "Come back to my place and you can show me what you can do".

It was the kind of offer you get from big Italian/Americans carrying violin cases and I had no intention of refusing. Not that I had a chance. And that's how I became involved with Masters, Doreen and Dunkirk. I'll write again when I stop shaking.

Yours,

Bob

PS: I keep waking up in a cold sweat from dreams where Doreen and Andrea meet. Thank heavens they can't breed.

attached or on line.

Do you or any of your readers know a method by which I could detect whether a printer is ready before I jump to the print routine in my program? – **Howard Johnson, Stockport.**

● Osbyte 128, with X = 252 and Y = 255 returns the number of spaces remaining in the printer buffer.

Using this call before and after sending some characters to the printer, you can detect if the characters have gone or are remaining in the buffer.

The following short program illustrates this:

```
   10 PROCass
   20 PROCtest
   30 END
   40 DEFPROCass
   50 DIM P% 20
   60 start=P%
   70 [OPT2
   80 LDX#252
   90 LDY#255
  100 LDA#128
  110 JSR&FFF4
  120 STX&8F
  130 RTS
  140 ]
  150 ENDPROC
  160 DEFPROCtest
  170 *FX15
  180 CALLstart
  190 ?&8E=?&8F
  200 VDU2,32,127,32,127,32
,127,3
  210 CALLstart
  220 IF ?&8E<>?&8F PRINT "
PRINTER NOT READY"
  230 ENDPROC
```

Printing problems overcome

I HAVE recently started to try and teach myself assembly language but I am stuck on how to print a large section of text on to the screen.

I know that you can load the accumulator with the Ascii code of a character and then use osasci to output this on to the screen, but this would take me ages to print the instructions for a program.

Please could you help me solve my problem? – **Jason Lee Hartley, Manchester.**

● The code following shows how to add a loop to your program. Note the text ends with character 255.

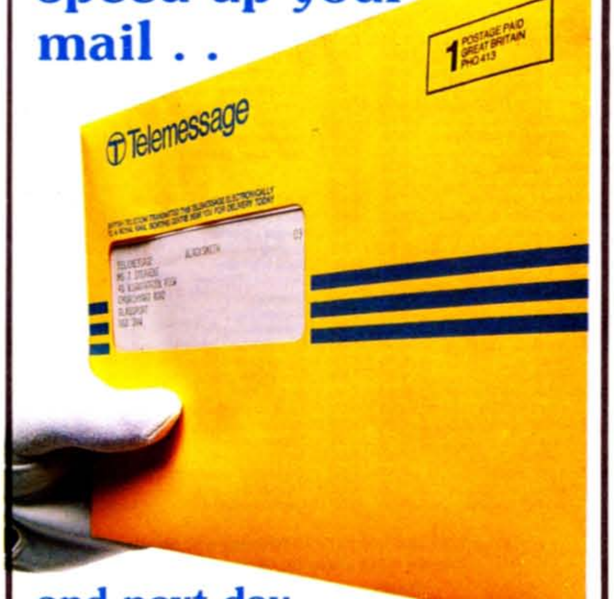
```
   10 DIM start 100
   20 OSASCI=&FFE3
   30 FOR pass = 0 TO 2 STE
P2
   40 P%=start
   50 [OPT pass
   60 LDX#0
   70 .loop LDA text,X
   80 CMP#255
   90 BEQ end
  100 JSR OSASCI
  110 INX
  120 JMP loop
  130 .end RTS
  140 .text
  145 ]
  150 NEXT
  160 $text=CHR$12+CHR$10+C
HR$10+"This is a test of a
routine"+CHR$13+"to put tex
t on the screen."+CHR$13+CH
R$255
  170 PRINT''"PRESS A KEY T
O EXECUTE THE PROGRAM":get
= GET
  180 CALL start
```

ALL programs printed in this magazine are exact reproduction of listings taken from running programs which have been thoroughly tested.

However, on the rare occasions when mistakes occur corrections are published as a matter of urgency. Should you encounter error messages when you type in a program, they will almost certainly be the result of your own typing mistakes.

Unfortunately we can no longer answer personal programming queries concerning these mistakes. Of course letters about suggested errors will be investigated without delay, but any replies found necessary will only appear in the mail pages.

Use your micro to speed up your mail . .



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Everyone knows that "first class" mail is far from perfect. The Consumers' Association reported in June that two out of every five first class letters fail to be delivered the day after they are posted.

So if you have an urgent letter that just HAS to be delivered tomorrow, what do you do?

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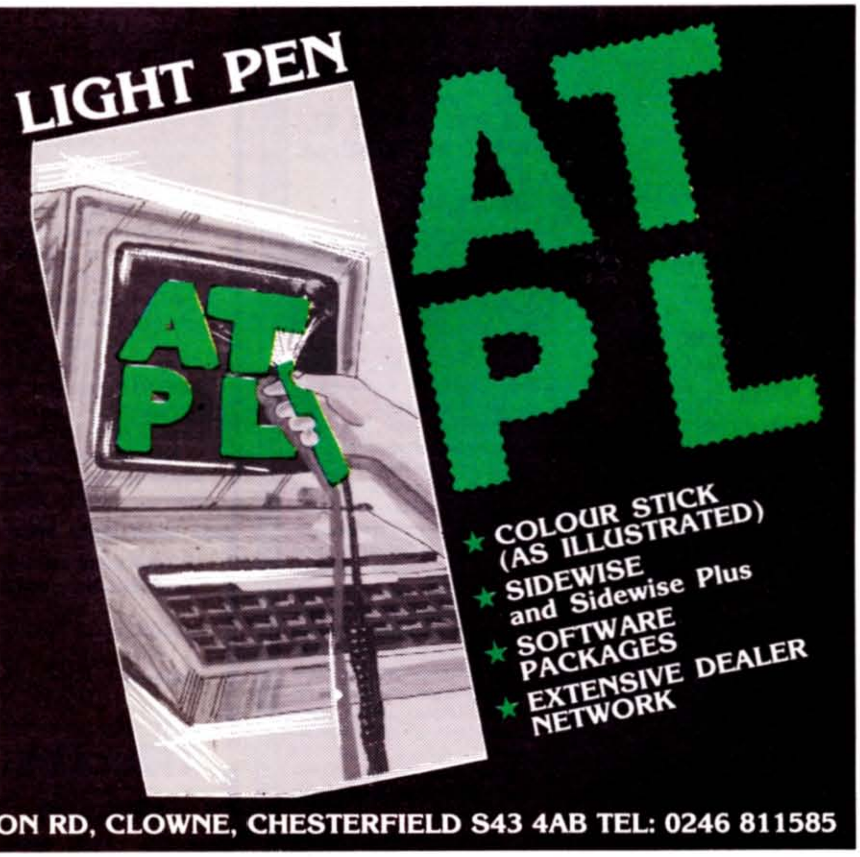
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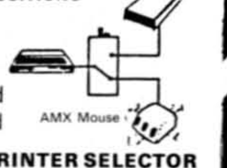

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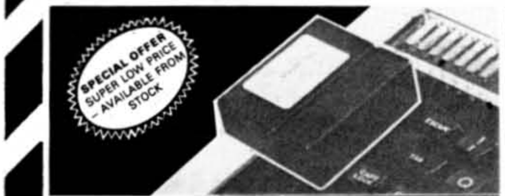

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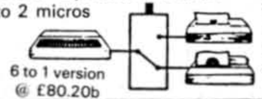

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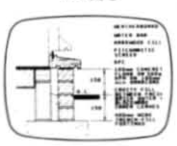
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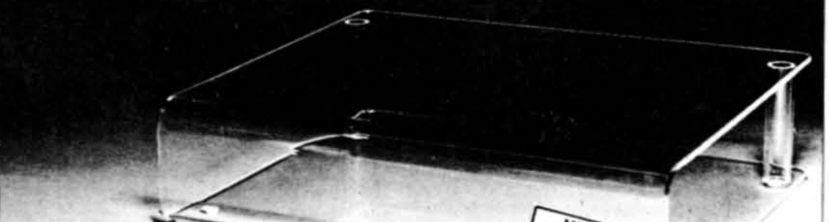

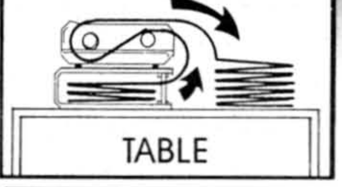

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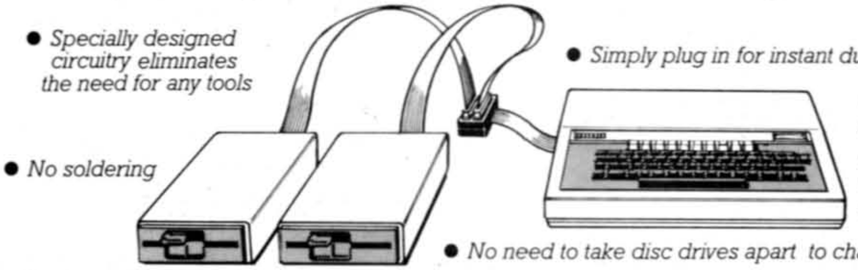

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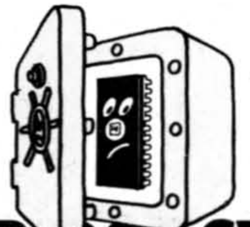

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I enclose Cheque/P.O. for £____________ Please add £2.50 for postage and packing (50p only for single cartridge)

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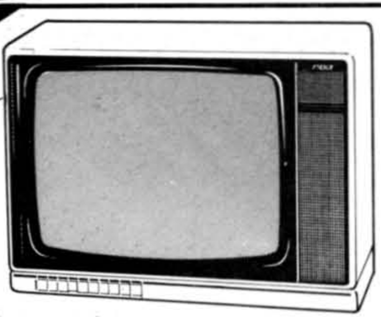
Monitors

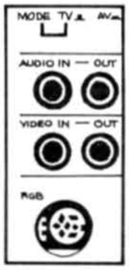
NEW

PHILIPS Colour TV/ Monitor Model 1114



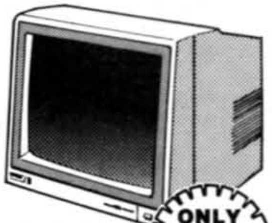
14" Tube (V34cm) Receiver/Monitor

● Light and compact finished in white with dark picture surround. ● In-line 14" picture tube provides a sparkling picture in seconds. ● Designed to give exceptional reliability and performance. ● 10 pre-select channel buttons. ● ● Headphone/tape recorder socket with separate loudspeaker mute switch. ● ● Loop aerial and main aerial connection. ● RF, CVBS and RGB inputs.



Price **£199** **inc. VAT**

PHILIPS Model BM7502 Green Screen Mono



From the highly successful 'Philips 80 Range', here is a monitor specially designed to display graphics and alphanumeric data with perfect clarity.
● 12" high resolution, 20MHz band width, anti-glare screen.
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ONLY £85 INC. VAT

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● Std resolution. ● Grey glass screen. ● RGB – linear/TTL – inputs (SCART/8 Pin DIN). ● Audio input. ● Bandwidth 8 MHz. ● Adjustable foot.

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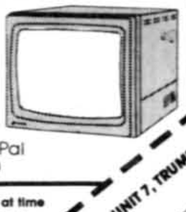
NEW

Model CM8533

● Med. resolution. ● Dark glass etched screen. ● ● Composite video input (phono). ● RGB – linear input (SCART). ● RGB/RGBI – TTL input (8 Pin DIN). ● Audio input. ● Green (Mono) switch. ● Bandwidth 12 MHz. ● Adjustable foot.

Price **£289** **INC. VAT**

Microvitec Monitors



Standard	**£219**
Med	**£289**
High	**£429**
Med & Pal	**£329**

Printers

Dot Matrix

Taxan Kaga KP810	**£249**
Canon PW1080A	**£279**

Daisy Wheel

Juki 6100	**£299**
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Please add £8 for 1½ metre length printer lead for the BBC micro.

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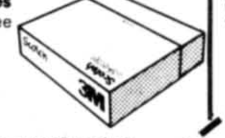

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SS 40 TRACK	**£13.00**
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Prices include VAT

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The Superb Mitsubishi 400K Model M4853 Double-sided 40/80 Track Disc Drive

Other Drives available from £89.00 inc. VAT

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40
80
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24th-27th July 1986
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Single Drive	**£129.00**
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Dual Drives 40/80 800K	
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All offers include

Utilities Disk includes formatting, verifying, BASIC program comparator, disassembler, Epson screen dump, dual catalogue (giving 62 files), large printing and many others.

Comprehensive Manual a fact-filled, 56 page document, includes techniques of loading from cassette to disk. Not available elsewhere

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Cheques payable to Viglen Computer Supplies
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The Great Little Printer from Viglen at a price everyone can afford

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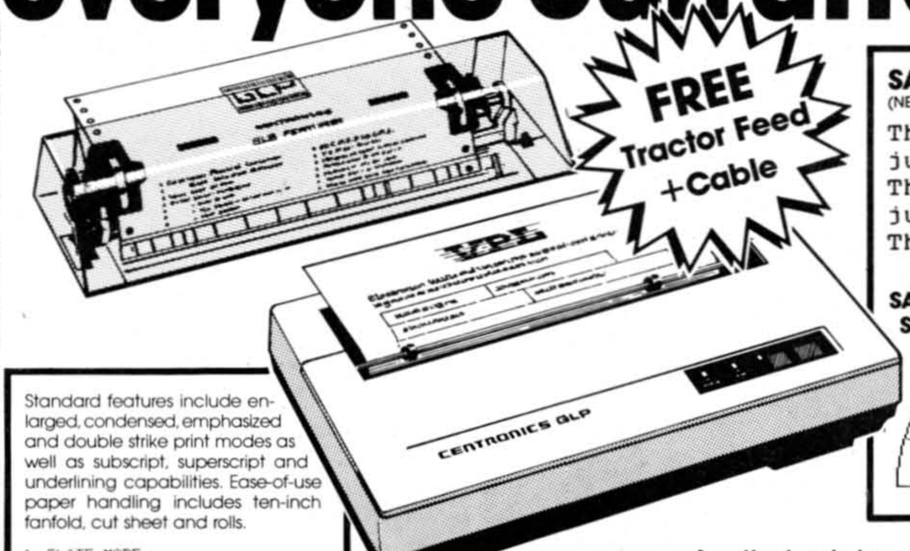


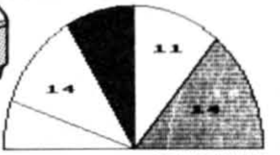
FREE Tractor Feed +Cable

SAMPLE OF NLQ
(NEAR LETTER QUALITY)

```
The quick brown fc
jumps over the la:
The quick brown fc
jumps over the la:
The quick brown fc
```

ACTUAL SIZE

SAMPLE USING EPSON SCREEN DUMP



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add £8.00 for carriage and insurance.

Tick ✓ whether ☐BBC or ☐IBM

Name..................................

Address...............................

....

....

I prefer to pay by ACCESS/BARCLAYCARD (delete as necessary).

Card No...............................

Signature.............................

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Win on every count, with a Viglen Winchester Drive for your BBC Master Series 128k or BBC B or B+

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100% ACORN ADFS COMPATIBLE

Price INC. VAT

20Mb Winchester with Acorn ADFS

£759 (28 megabytes available for an extra £50 inc VAT)

(28Mb, 40Mb, 56Mb and dual versions up to 112Mb available – please call)

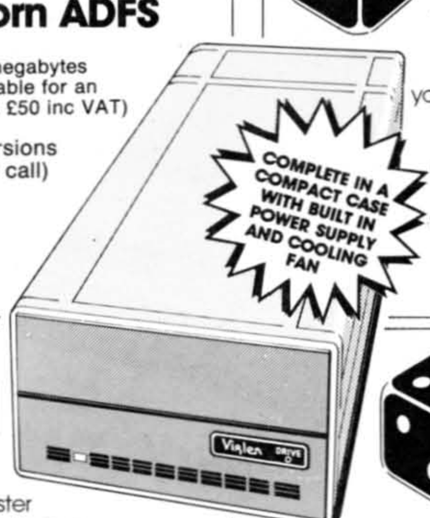
Acorn 1770 Upgrade Kit

Enables you to run your BBC B with the floppy discs in double-density ADFS Mode.

£49.95 INC. VAT

Compability

The Viglen Winchester is ready to plug in and use straight away on a BBC Master Series. On a BBC B or B+, you will need to fit the Acorn ADFS Rom. Viglen believe this is the only truly 100% Acorn ADFS compatible unit currently available. You can use up to two floppy disc drives in conjunction with the unit. Fit the Acorn ADFS to the B+ and the floppies can double their capacities by running in double density mode.



COMPLETE IN A COMPACT CASE WITH BUILT IN POWER SUPPLY AND COOLING FAN

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The Viglen Winchester takes under 2.5 seconds to save 200KBytes, making it at least 10 times faster than the equivalent floppy disc system.

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The Viglen 20Mb Winchester is equivalent in capacity to two hundred 100K floppies or fifty 400K floppy discs.

What is a Winchester?

A Winchester Drive is a sealed unit containing one or more hard discs and works in principle like a floppy disc drive. The discs are permanently rotating at high speed so giving a much faster access time. The discs cannot be changed, but with such a vast memory capacity, it is not usually necessary to do so.

The Viglen Winchester Unit consists of the following:

1 Winchester Drive, Controller Board and special designed power supply fan – all fitted in one compact case. Fan cooling is essential for all Winchesters.
2 Acorn ADFS Rom **3** Acorn ADFS Manual
4 Acorn ADFS Utility Programs
5 Winchester User Guide
6 Additional Utilities on the Winchester including Formatter and Verifier.

The dice must be loaded in favour of

Viglen

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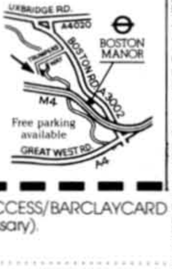

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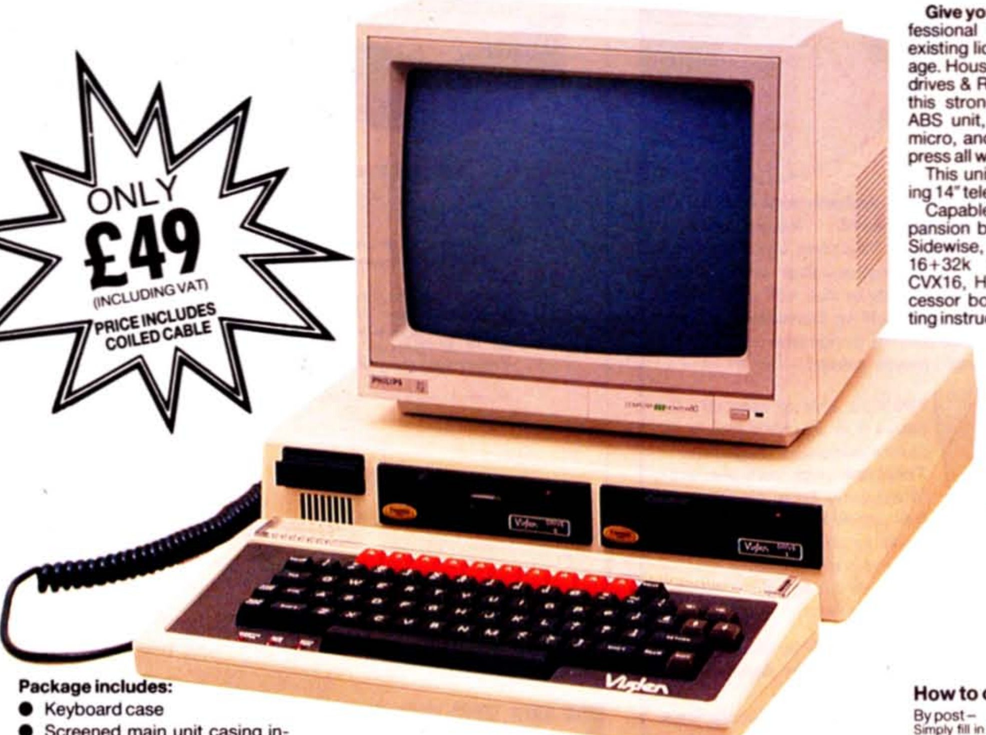
GIVE YOUR BBC THE PC LOOK

WITH THE Viglen PROFESSIONAL CONSOLE UNIT (P.C.U.)



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PRICE INCLUDES COILED CABLE

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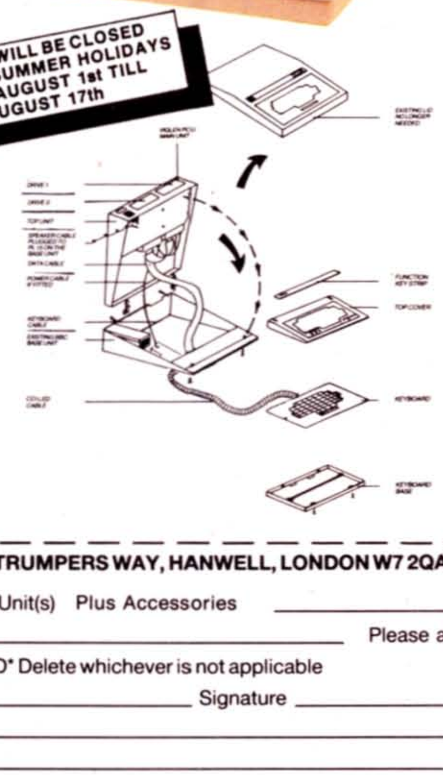

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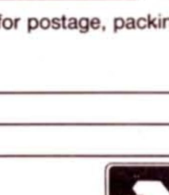

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Streamer for Acorn Winchester	*£1250*
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The Amcom Streamers use high quality metal tapes which allow over 18 M Bytes of data to be stored on each. The Amcom streamer is capable of backing up 10 M Bytes of data in about five minutes with a revive time of around half an hour.

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BBC Micro
Model B, B+
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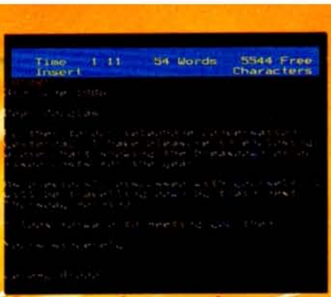
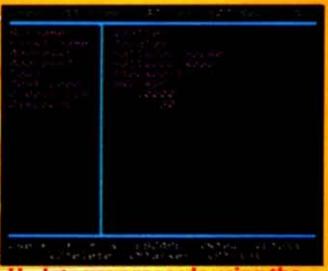
Main menu
Word Processor
Database
Spreadsheet
Graphics
Communications
Label Printer
Exit Mini Office II
Use cursor keys to choose
then press RETURN
(c) Database Software 1986
Cassette version



```
Time   1 11      54 Words     5544 Free
Insert                       Characters
```

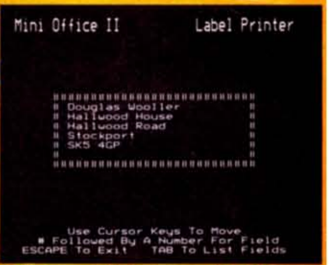
Compose a letter on the WORD PROCESSOR

Then use the mail merge facility to print out personalised circulars.



Update your records using the DATABASE

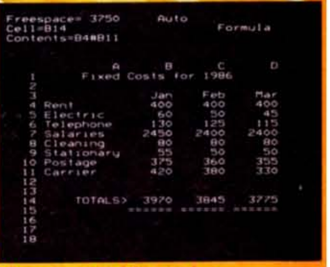
Build up a versatile card index with detailed facts at your fingertips.



```
Mini Office II                Label Printer



     ################################
     # Douglas Wooller              #
     # Hallwood House               #
     # Hallwood Road                #
     # Stockport                    #
     # SK5 4GP                      #
     #                              #
     ################################



         Use Cursor Keys To Move
      # Followed By A Number For Field
   ESCAPE To Exit    TAB To List Fields
```

Print out addresses with the LABEL PRINTER

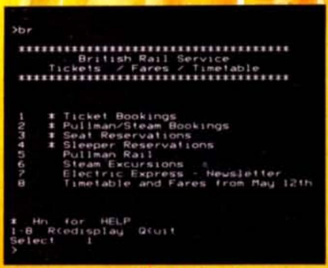
Create labels of any size or shape and then print them out in any quantity.



```
Freespace= 3750      Auto
Cell=B14                         Formula
Contents=B4#B11

                A         B         C         D
  1         Fixed Costs for 1986
  2
  3                      Jan       Feb       Mar
  4 Rent                 400       400       400
  5 Electric              60        50        45
  6 Telephone            130       125       115
  7 Salaries            2450      2400      2400
  8 Cleaning              80        80        80
  9 Stationary            55        50        50
 10 Postage              375       360       355
 11 Carrier              420       380       330
 12
 13
 14         TOTALS>     3970      3845      3775
 15                   ======    ======    ======
 16
 17
 18
```

Prepare a table on the SPREADSHEET

Produce exactly the format you need with the powerful editing facilities.



```
>br

 ***************************************
        British Rail Service
     Tickets  / Fares / Timetable
 ***************************************



 1    * Ticket Bookings
 2    * Pullman/Steam Bookings
 3    * Seat Reservations
 4    * Sleeper Reservations
 5      Pullman Rail
 6      Steam Excursions
 7      Electric Express - Newsletter
 8      Timetable and Fares from May 12th


*  Hn  for  HELP
1-8  R(edisplay  Q(uit
Select    1
>
```

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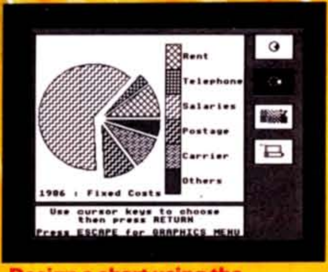
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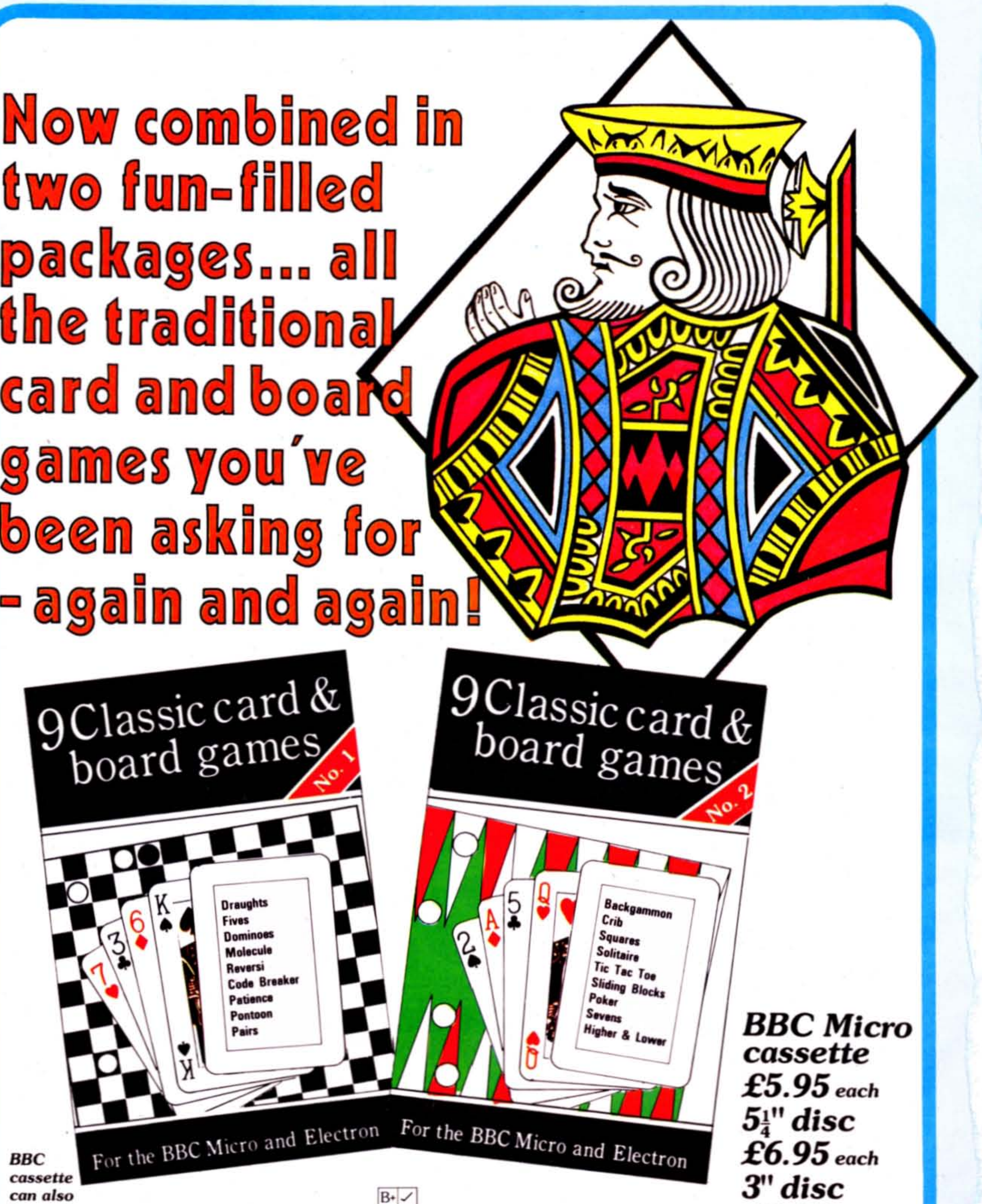
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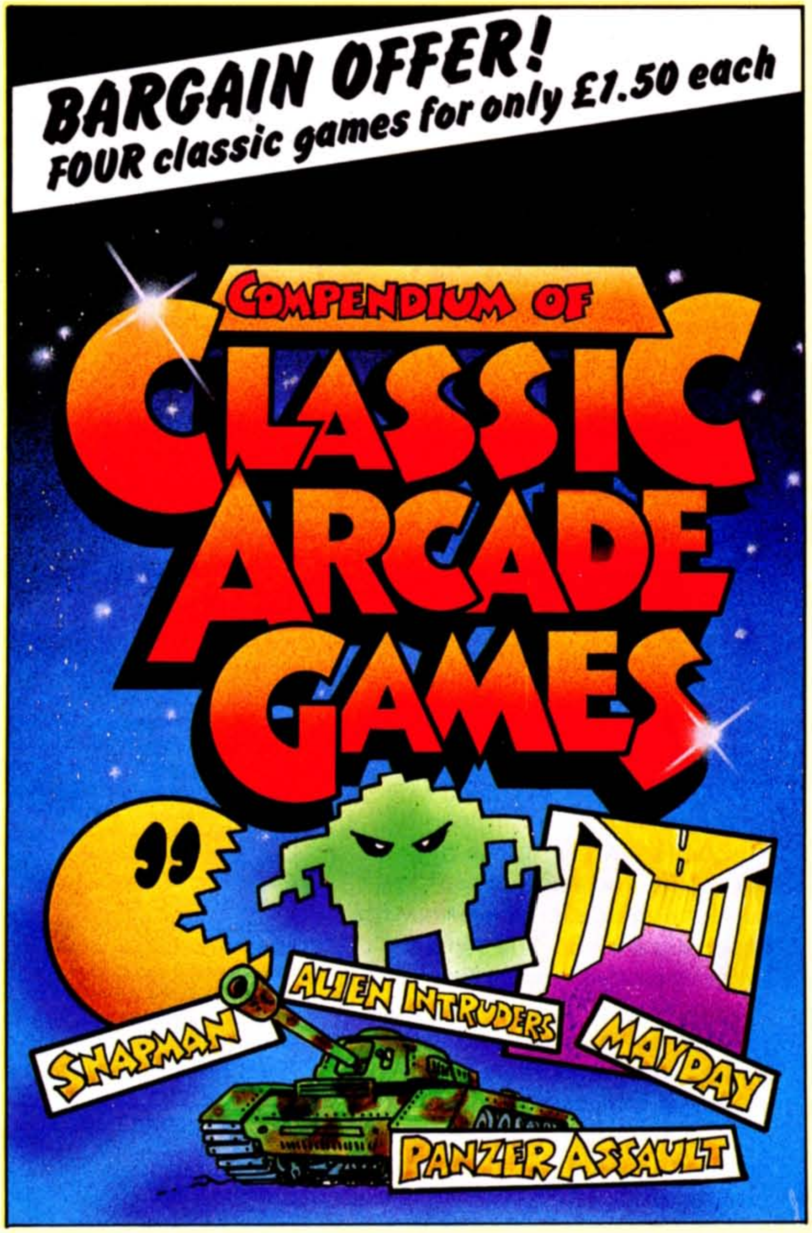
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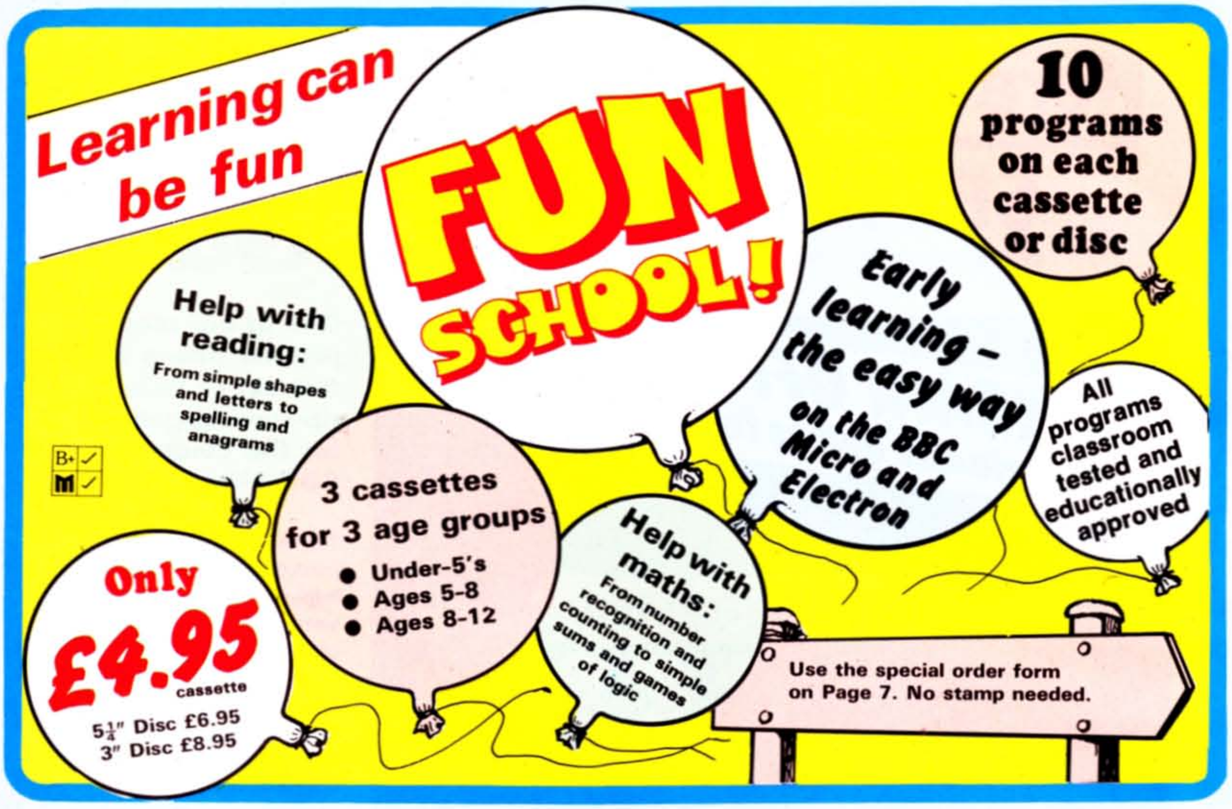
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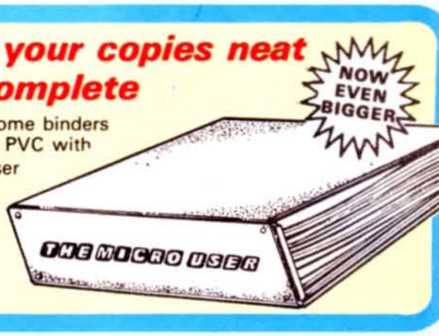

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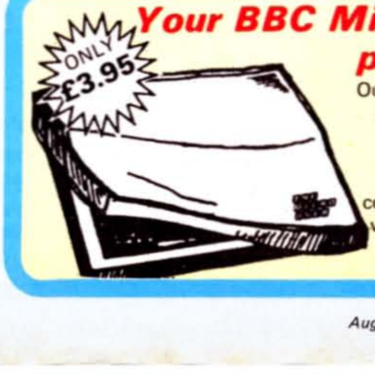

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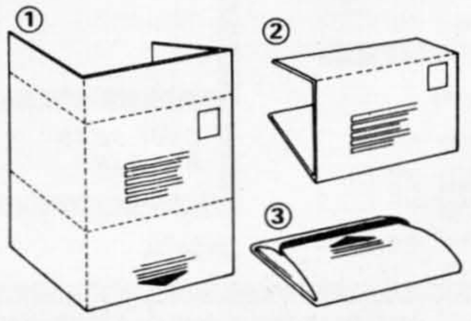

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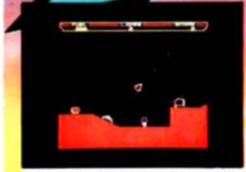
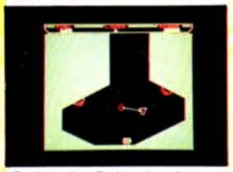
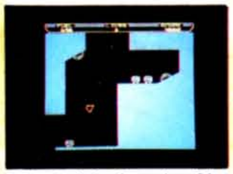


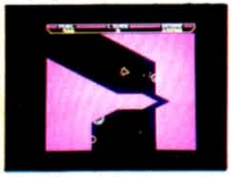
The first mission — destroy the reactor for a bonus score.



Retrieve the Pod and make your escape.



Collect the fuel and steer clear of the limpet guns.



Shoot the activator to open the sliding entrance door.

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To add to the challenge, the planets have different gravity rates and, as you progress through the game, some have "reverse gravity" or "invisible landscapes". They are defended by automatic limpet guns strategically placed to protect the pods and fuel tanks — the only source of replenishment for your limited fuel supply. The smooth screen-scrolling, which is exemplary, and the realistic action gives the player a fascinating feeling of floating through space.

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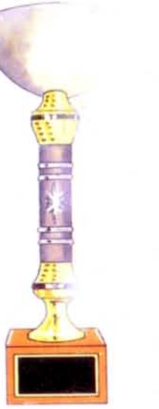

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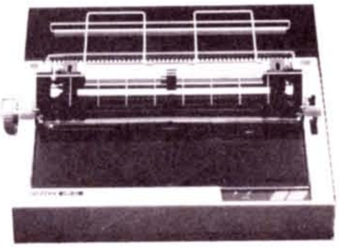

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Does your micro earn its keep?

JO STORK examines the points to consider when assessing your system's cost/benefit ratio

I HAVE mentioned cost benefit ratios several times in previous months without ever fully explaining what relevance they have or how they are calculated.

Since it is this ratio which must govern every commercial decision that you make I will now put this omission right and discuss the subject. What follows applies equally to a micro or the most powerful super mainframes currently available, although the actual examples used will be for the BBC Micro.

The first stage is to accept that everything you do with your BBC Micro is going to incur a cost, and that these costs will arise in one of the following seven areas:

- Purchase of the initial BBC Micro system itself.
- Purchase of additional peripherals and hardware.
- Purchase of the software to perform the business task.
- Time required to gain familiarity with the hardware and the software.
- Time required to create the data files and/or transfer the data files from the previous system.
- Time required to keep the system up to date, in other words to make the daily/weekly/monthly entries.
- Costs of supplies such as discs, special stationery, ribbons and the like.

It is obvious from this list that there is considerable scope for what is known in government circles as creative accounting, but if the organisation is to maximise its profits you must access each element of the costs as rigorously and objectively as possible.

There are two possible ways of looking at the cost of the investment in the system.

The first is that you can, like many users, decide that the computer was bought in order to provide home amusement or serve as some kind of educational and mathematical resource.

This is perfectly reasonable, but is likely to result in disguising significant cost elements. The only way to arrive at an accurate figure is to determine how many hours in a typical month the BBC Micro will be used for domestic tasks and how many for commercial tasks.

Assuming that the BBC Micro cost £400, domestic tasks occupy 40 hours per month and commercial tasks will occupy 25 hours per month the costs to be set aside will be £400*25/65 = £154. As the other cost elements, particularly the timings, are determined this value may have to undergo some modification.

The second method applies when going out to buy a micro specially for the commercial task, in which case the whole of the cost will have to be set aside as costs.

At first sight calculating the costs of the additional peripherals and hardware might appear to directly parallel the calculation for the BBC Micro itself, but this is not the case. It is easy to argue that you wanted a printer or second disc drive anyway, and therefore proportion the costs as before.

If the domestic applications were operating satisfactorily – albeit probably not ideally – without such equipment then the whole of the costs must be set against the commercial task. Normally a better quality printer is required, a few go-faster chips, superior monitor and more or larger capacity disc drives will be required, except for all but the very smallest operation.

If you sell off some of the existing equipment take this revenue off the costs. It is never regarded as a benefit.

If all you do is scour the pages of *The Micro User* for your software and just send off a cheque for an off-the-peg piece of software then the price is a straight cost.

The problem of calculation arises when you decide to write the system for yourself. The first thing to do is decide how you rate your time. Consultants charge anything up to £350 for an eight hour day. It is easy to decide that since you enjoy hacking anyway no costs need be applied.

However this is totally false, since the 10 to 100 hours could have been spent elsewhere, and that might have been revenue-producing anyway. If you know your hourly rate accurately use this. Otherwise as a rough guide assume £10 per hour and do not forget to include all the time spent testing the system and producing the operating guide.

If the system involves getting a new BBC Micro you must allow sufficient time for setting up the system, finding your way round its features and, if intending to write the system for yourself, gaining familiarity with BBC Basic.

Whether the micro is a special purchase or not the same hourly rate is applied for the time needed to learn the software operations. Only if you are writing the system for yourself will this be zero, since surely no one is so foolish as to believe they can start producing a new system until totally at ease with the technical considerations.

Also do not forget that many systems must be kept up to date, whether the main operator is available or not. Consequently do not forget to include the time to train understudies at the hourly rate appropriate to them.

When calculating the cost of file creation/transfer you must remember that even the most capable of operators can only type at a maximum rate of three

→

Fixed Costs:	
Cost of BBC Micro = £600 *25/40	£400
Cost of additional hardware – printer, second disc drive	£380
Cost of software	£140
Cost of gaining familiarity – 12 hours at £12.50 per hour	£150
Cost of file creation – 38 hours	£475
	Total: £1,545
Apportioned over three years – estimated system life	£10/week
Running Costs	
Fixed cost apportionment	£10
Daily running costs – six hours per week	£75
Supplies cost	£8
	Total: £93/week

Figure I: Breakdown of costs

From Page 3

characters per second, in other words 10,000 keystrokes per hour. Assuming an eight hour working day, by the time they have had lunch, tea and comfort breaks, plus the inevitable other interruptions, they have done well if they complete 55,000 keystrokes in a boring, weary day.

This might seem like a lot until three other factors are considered – firstly spaces and, most importantly, carriage returns account for a keystroke each. Secondly considerable time will be needed to discover and collate all the information that is required prior to the data entry. Finally a simple stock file of 2,000 records containing only 80 characters per record will occupy 160,000 characters.

Keeping this in mind it should come as no surprise to find that a fortnight may be needed to enter the start-up data into even a small system. Multiplying the time required by the hourly rate can therefore give some unexpectedly large costs.

When calculating the cost of day-to-day operations the same 55,000 keystrokes per day basis should be used for the data entry. However do not forget the time that will be required for file sorting, printouts and backing-up.

When calculating the costs of the supplies remember that special stationery, ribbons and the like can be expensive. We are all guilty of using ribbons long after they should have been junked, particularly if most of the printer's work is program listing. However sending an invoice in an eye-straining, faint ink on a flimsy sheet of cheap paper is hardly going to impress the recipient of the professionalism of the organisation.

Let's now look at the typical total cost. A couple of weeks ago I provided a simple system for a typical BBC Micro user, who had originally got the computer during the boom Christmas of 1984 in order to help his child's education. He had a single disc, medium resolution monitor and a totally unsuitable printer. The break-dowm of costs is shown in Figure I.

This figure might surprise many, but there is worse to come. Because most costs get under-estimated and most benefits over-estimated it is not enough to provide £93.01 per week of benefits. The cost/benefit ratio must be at least 1.5 – in other words we have to find £140 per week of benefits.

This is where the assessment becomes most difficult. If this amount can not be found you will have to accept that the computer will be a cost to the organisation and not a benefit.

The benefits fall into two main groups – the time saved through using the computer and tasks which would be impractical without the computer. Since the first of these is obvious I won't discuss it at length. Anyone who has used even the simplest of word processors will realise that letters take about half the time compared to using an ordinary typewriter.

It is the previously impossible tasks which causes the calculation problems. This is because placing a value on something as arbitrary as providing full justification of the letter, different font styles and the like is usually subjective.

The question of providing better management information, which had been used by many mainframe computer salesmen to boost the benefits side of the equation, is even more difficult to assess.

Using the computer to predict when a stock-out might occur may be vital to some users if the delivery lead time is long and the sales which could be lost is large. Conversely in another organisation it may be of no significance if resupply at short notice is possible and the orders for the item are few and far between.

One of the major benefits of using the computer is when it becomes an electronic crystal ball, such as a spreadsheet predicting actual against predicted values. The improvement in cash-flow analysis, thus making savings on borrowings and therefore of interest payments, longer term planning or general improvements in efficiency, can be highly significant.

Finally let's examine typical system savings. Returning to my client who had to find £140 per week of benefits, the breakdown was as follows:

Hours per week saved = 14 hours current – six hours on computer = eight hours @ £12.50 per hour	£100
Average reduction of £1,750 in bank borrowings @ 14 per cent a year	£5
Better work scheduling resulting in 7.5 per cent improvement on £48,000 per year turnover	£70
	Total: £175/week

This therefore produced a cost/benefit ratio of 93:175, or 1.88. Even if all these benefits do not materialise and the costs were under-estimated it is highly unlikely that the use of the computer will be a financial drain on his company. However as an exercise you might like to recalculate the costs on the basis of having to buy the equipment rather than upgrade an existing system.

It is frightening how infrequently a rigorous approach is adopted – if it were then many systems would never be sold. Computers are immense fun, and it is easy to diguise the costs behind a facade of keeping up-to-date or pastime. Unfortunately showing a profit is hard enough without falling into the trap of mixing business with pleasure quite so directly. ■

Tandata's Tm 512 tops IQ charts

GABRIEL JACOBS reviews an intelligent modem and two accompanying programs – Tango and Addcom

IF you've not used a smart modem before, and particularly if you're used to a manual modem, you'll be impressed with the intelligence and flexibility of the Tandata Tm 512.

At a single keystroke it will dial a number, auto-detect the baud rate of the answering modem, send a log-on/ID string with appropriate delays, carriage returns and so on, and automatically redial if the number is engaged.

Its battery-backed RAM will store up to eight telephone numbers and auto log-on instructions together with all previously set comms parameters, so at power-up everything is as you left it. It will also answer your phone, send a carrier signal and hook up to the modem originating the call, whether you happen to be around or not.

It is housed in a slim-line, black case. At the back are power and telephone cables, TTL 6-way DIN and RS232 D sockets, and a standard PST – 600 series – telephone socket for passing on the line to a handset. At the front are an on/off button and five LEDs – power, line seizure, carrier detect, transmit and receive.

Baud rates handled in both dial and answer modes are 300/300 full duplex, 1200/75 full duplex and 1200/1200 half duplex.

Commands which can be sent to the built-in software include a wide range of control codes covering most contingencies. For instance, the modem can be programmed to wait for a secondary dialling tone before continuing with the rest of the number.

It can also be made to stop dialling until an underline character – Ascii decimal 95 – is sent from the keyboard, tone-dial or pulse-dial, wait a preset time before answering the phone, accept new cursor movement sequences and so forth.

With its own power supply the Tm 512 will hook up to any micro fitted with a standard serial interface, and will therefore connect straight into the BBC Micro RS423 port.

It will also work with any suitable comms software, But Tandata produces two ready-configured BBC comms programs which come free with the modem – they are also available separately.

One is for viewdata (Prestel), and the other for teletype communications such as transferring files, sending and receiving electronic mail, or accessing remote non-Prestel databases and bulletin boards. They are supplied on cassette, disc or ROM, and come complete with a made-up cable.

The viewdata program, called Tango, turns the BBC Micro into a Prestel-type terminal. It is controlled for the most part very easily via the function keys, allowing you to save and send pages, and to download telesoftware with full automatic error-checking.

There is also a facility for tagging up to 25 frames for later retrieval, and a Prestel editor with a full range of graphics and colour options.

The Tango documentation takes you step by step through the various facilities offered, and includes excellent appendices with clear explanations of Escape and Control sequences, mosaic codes and relevant *FX commands. With this information it is possible to change virtually any default value, and therefore to configure the program for other modems.

My only criticism is that if you try to take a hard copy of a currently displayed frame without a printer attached the program hangs and has to be recalled. There really is no excuse these days for allowing that situation to arise.

The terminal program, called Addpac, is far less impressive than its Prestel counterpart. It has facilities for spooling, printing and sending files, but almost any teletype software will provide these basic routines. What distinguishes a good comms program from a mediocre one is the clarity of the user-interface.

The Addpac interface manages to combine poor presentation with some unexplained jargon. Most beginners will understand a 40/80 column toggle and even a choice of printer types, but they are unlikely to know what to choose when it comes to setting "Transmit to line CPS" with no proper explanation of it in the documentation.

That omission is not an isolated one. In fact, in contrast to those of Tango, the instructions for using Addpac are rather poor, and it beats me how the same firm can have produced both sets.

However I would have willingly believed that this discrepancy was some kind of aberration were it not for the third manual – the one that goes with the Tm 512 modem itself.

This is even worse than the documentation for Addpac. All the necessary – and some unnecessary – technical information is there, but it is badly organised and in places almost incomprehensible.

At the time of writing there have been six issues of this manual, each an improvement on its predecessor, but a huge leap would be required to bring it to a level where a first-time modem user could make sense of it.

At power-up the software in the modem offers a choice of Directory (on-line) or Program (off-line) modes, and it can take ages just to work that out from the modem manual.

The Directory mode screen presents the eight stored

→

From Page 5

telephone numbers ready for auto-dialling, but it is also possible to dial unstored numbers by addressing the modem directly from the keyboard.

Program mode invokes Store 9, which serves two purposes – it controls the phone number stores and holds information concerned with auto-answering.

Again any of the auto-answer facilities can be implemented manually. A wide range of options is available, from Chat mode with or without auto line feed to forcing another modem originating a call to transmit on the high channel – that is at 1200 rather than 75 baud.

Once everything is set up correctly it's plain sailing. In Directory mode you press the appropriate store number. The modem takes the line – indicated on an LED, a "Dialling" message appears on the screen and the modem's internal speaker echoes the usual pulse-dial signals.

When a valid carrier is detected the Carrier LED lights up and the speaker switches itself off. If anything goes wrong, such as a number being engaged or unobtainable, an appropriate message is displayed on the screen.

Answering the phone is even easier, since you need to do nothing at all if the auto-answer store has been properly configured for the incoming call. Or you can answer on voice then send a carrier to the originator of the call when you're both ready.

In terms of the total market the Tm 512 is middle-of-the-range, but unless your requirements are very special – such as 1200/1200 full duplex, very high baud rates or Hayes compatibility – it will provide everything you're likely to need.

You can find modems which do as much as the Tm 512 for around the same price – £255 – or even cheaper. But with Tandata you know you're buying from a respected firm with a reputation for after-sales service to uphold, and that's got to be worth something. A Hayes-compatible version of the Tm 512 has just been released at £275.

If you want to buy Tango or Addpac without the Tm 512 they will set you back £17 each on cassette, £25 each on disc or £40 for both together on ROM. Tango is certainly a good buy, but Addpac in my view is not worth its salt.

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Mastering the waves with a BBC Micro

REGINALD JONES meets sailmaker expert MICHAEL McNAMARA

FOR centuries the art of sailmaking has been back-breaking and time consuming. Since the days of Trafalgar, sailmakers had to crawl about on designs chalked on the floor continually having to peep under the canvas to follow the pattern as they cut out their sails.

And sailmaker expert Michael McNamara was no exception – until a specially written designing program was written for his BBC Micro. Now Michael, 14 times a national sailing champion since 1967, can cut the same sails on a table just four foot wide thanks to the panel measurements and curvatures he produces on the micro for his customers to see and his cutters to follow.

Cutting out a spinnaker used to take two days. That time is now halved. "I am delighted with the results, which save me both time, money and the back and knee aches from crawling about floors", said Michael at his shop in Exmouth, Devon.

In 20 years, starting with his own £10 sail which he ran up on a sewing machine, he built up a business which now has a £150,000 turn-over.

The new program has increased his profits by some 15 per cent, particularly on larger sails where there is a large saving on wastage. He exports to the Middle and Far East, India, Pakistan, Malta and Canada.

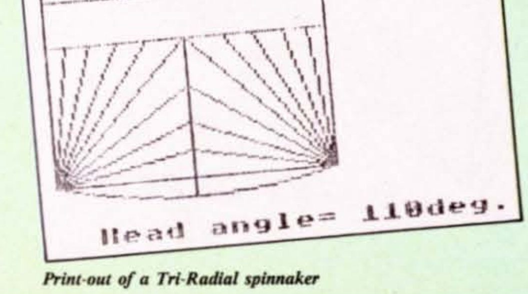
Michael, twice an Olympic trialist, has made sails for international yachtsmen including Philip Crebbins, an Olympic class helmsman who is now adviser to the America Cup squad. The polyester and nylon sails cost from £130 for the smallest to £1,500 for big ones.

The program was written by Superintendent Nicholas Crowhurst, a sailing friend and computer officer with the Devon and Cornwall Constabulary. In his off-duty time over four winters he closely studied Michael's methods of designing sales – making detailed notes and calculations.

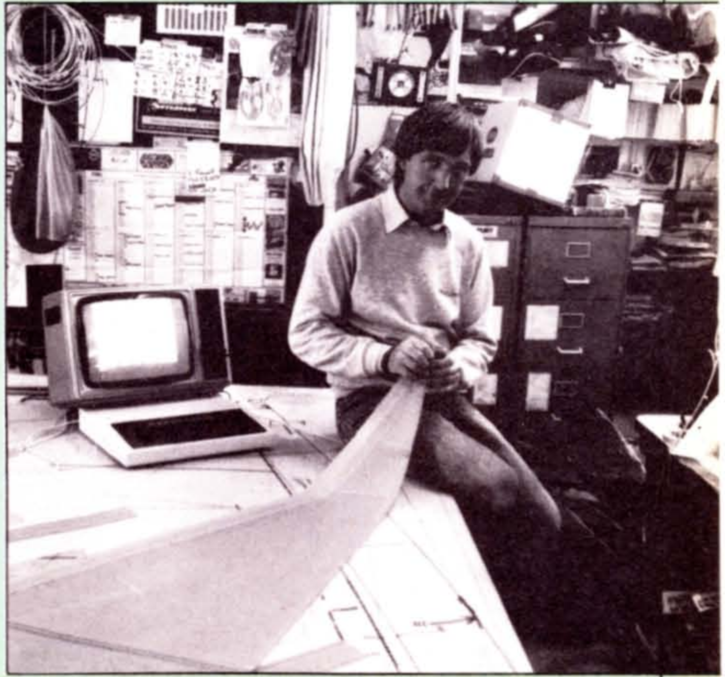
Nicholas said: "There are several such programs on the market, costing thousands of pounds, but none appeared to offer the answers to his problems. In all of them the sailmaker – the artist – lost control of his understanding of just how his shaping actually sculptured the sail.

"My view was that any such system would sap the confidence of the sailmaker and, within a short time, he

→



Print-out of a Tri-Radial spinnaker



Michael McNamara with his BBC Micro while working on a new sail design

From Page 7

would feel unable to cope without the computer".

Nicholas realised Michael needed a system which would allow him to retain complete control, yet delegate to the computer time-consuming tasks like drawing to scale, preparing instructions for staff, quotations and other jobs not requiring expertise.

For him the project became an all-consuming hobby. The program he wrote includes such details as boat length, mast height, boom size and whether the boats are for cruising or racing under the International Offshore rules.

Now Michael merely picks which type of sail he wants for a particular boat. The micro then produces a printout of the most suitable sail with the sort of details usually obtainable from a scale drawing, like the number of 3ft wide panels needed. The program indicates the length of each seam and its distance from the bottom of the sail.

At this point the sailmaker's skill decides how much to curve the edges of each panel of cloth – the vital element to allow smooth deflection of the wind for increased speed.

Nicholas said: "This is the sole part of the operation which requires Michael's specialised skills. When the computer has received these final instructions it re-draws the sail to take account of the curved panel edges and prints out the instructions for the cutters and machinists".

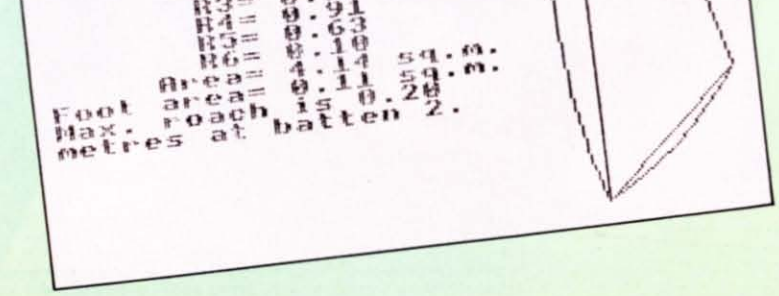
The system aids the design of mainsails, jibs, genoas, tri-radial, radial-head and Starcut spinnakers. For boardsails, used by surfers, the program features a facility to call up stock designs and then modify them on the screen within two seconds.

Michael said: "All the backbreaking tasks have been simplified by the program. With the printouts we can cut out each section. The size of the panels is so organised all we have to concentrate on now is the stitching and edges".

Michael McNamara (right) receiving the GP14 National Champions Award for 1980 from the wife of the Commodore of the Mubles Yacht Club

Customers can call in, select designs appearing on the BBC Micro's screen and even have modifications incorporated after seeing printouts. "It is a great advantage to both me and the customer, and saves time and costs. Nick's efforts have had fantastic results and I am grateful to have a personalised program", said Michael.

His own-designed sails have helped him win many titles – including the most recent, the Hornet Class national championship at Babbacombe, Devon. Such success reflects his skill and dedication to the sailing world – a world to which the micro now adds an extra dimension and of course, has put an end to those aching knees.



```
BOARDSAIL DESIGN FOR
MICRO-USER
 Cut-out=  1.22
 Luff,L1=  4.60
    Boom=  1.40
Roach,R1=  0.28
      L2=  3.67
      L3=  2.86
      L4=  2.12
      L5=  1.70
      R2=  1.11
      R3=  0.96
      R4=  0.91
      R5=  0.63
      R6=  0.10
    Area=  4.14 sq.m.
Foot area= 0.11 sq.m.
Max. roach is 0.20
metres at batten 2.
```

Print-out of the top section of a Broadsail design

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INTER-WORD

INTER-WORD is the ultimate word processor for the BBC micro. Just look at its features:

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- Documents may be edited in any of 40, 53, 80 or 106 column screen modes.
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- Multi-column printout.
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- Easily set preferences including: screen colours, key repeat rate, line numbering, cursor line, etc.
- Printer setup to allow simple access to any printer effects on any printer.
- Pull down menu driven throughout. Menus exist for printer setup, page size, preferences, spelling check, status, etc.
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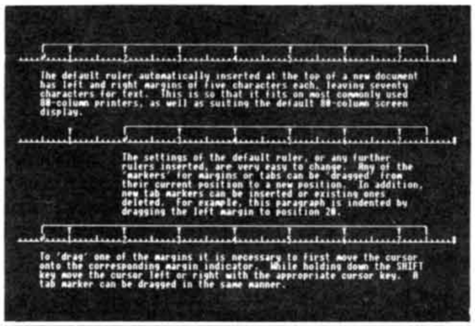
- ALL FEATURES OPERATE FULLY ON: MASTER, B+128, B+, standard-B, B with Watford or Aries shadow RAM.

ROM-LINK programs can all hold their data in memory simultaneously. In fact, each may hold more than one set of data. This means that INTER-WORD can cope with more than one document in memory at once.

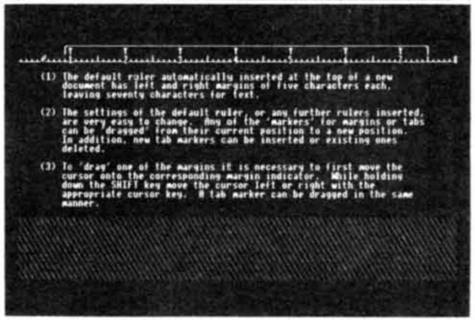
THE INTEGRATED WORD PROCESSOR FOR THE BBC MICRO



```
The default ruler automatically inserted at the top of a new document
has left and right margins of five characters each, leaving seventy
characters for text.  This is so that it fits on most commonly used
80-column printers, as well as suiting the default 80-column screen
display.

                    The settings of the default ruler, or any further
                    rulers inserted, are very easy to change.  Any of the
                    'markers' for margins or tabs can be 'dragged' from
                    their current position to a new position.  In addition,
                    new tab markers can be inserted or existing ones
                    deleted.  For example, this paragraph is indented by
                    dragging the left margin to position 20.

To 'drag' one of the margins it is necessary to first move the cursor
onto the corresponding margin indicator.  While holding down the SHIFT
key move the cursor left or right with the appropriate cursor key.  A
tab marker can be dragged in the same manner.
```



```
(1) The default ruler automatically inserted at the top of a new
    document has left and right margins of five characters each,
    leaving seventy characters for text.

(2) The settings of the default ruler, or any further rulers inserted,
    are very easy to change.  Any of the 'markers' for margins or tabs
    can be 'dragged' from their current position to a new position.
    In addition, new tab markers can be inserted or existing ones
    deleted.

(3) To 'drag' one of the margins it is necessary to first move the
    cursor onto the corresponding margin indicator.  While holding
    down the SHIFT key move the cursor left or right with the
    appropriate cursor key.  A tab marker can be dragged in the same
    manner.
```

ROM-LINK

The ROM-LINK suite, of which INTER-WORD is an important part, is a uniquely flexible set of integrated ROMs, compatible with all models of the BBC micro.

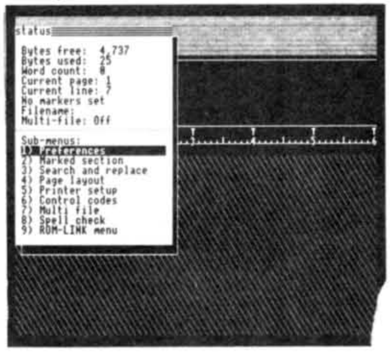
MONEY-BACK

Guarantee

Buy INTER-WORD—if you don't like it—send it back for a full refund!

(Available when purchasing direct from Computer Concepts)

- Data may be transferred from one program to another with the minimum of effort. A spreadsheet may easily be transferred to INTER-WORD and re-arranged to suit the format of the document. Similarly a spreadsheet set up in INTER-WORD may be directly imported into INTER-SHEET.



```
status

Bytes free:  4,737
Bytes used:  25
Word count:  0
Current page: 1
Current line: 7
No markers set
Filename:
Multi-file: Off

Sub-menus:
1) Preferences
2) Marked section
3) Search and replace
4) Page layout
5) Printer setup
6) Control codes
7) Multi file
8) Spell check
9) ROM-LINK menu
```

INTER-WORD is 32K long (longer than any other BBC word processor)—BUT—due to a unique design, it is supplied in just ONE CHIP compatible with all machines.

No other so-called integration system is as powerful. Other systems can only transfer data in a very limited way, making it impossible to transfer figures from the word processor into the spreadsheet for example. No other system can support data from different programs in memory at the same time.

COMPATIBLE WITH THE BBC MICRO MODELS B, B+, B+128 & MASTER

INTER-WORD

INTER-WORD shows an accurate image of the final printed text during editing. It is continually re-formatted as new text is entered, so ensuring that the screen always accurately represents the final document. Justified text is also shown while editing; this includes left, right and fully justified and centred text.

The layout of text is controlled by rulers. These are extremely easy to insert and just as easily changed to give a different format. Any aspect of the ruler can be changed by 'dragging' its position marker using the cursor keys. No description can do justice to the intuitively simple ruler editing.

Although embedded commands are little used in INTER-WORD, some embedded commands are still allowed and may be 'hidden' in the text without upsetting the screen format, appearing only if they need to be edited. ANY codes for ANY printer can be included at ANY point within the text. Standard effects such as bold and underlining are shown on-screen. A simple printer code menu allows codes for any printer to be easily included.

Multiple-column printout facility is an integral feature. After setting the text width to suit one column and setting the number of columns, printing out is just a matter of pressing a key.

INTER-WORD uses a similar method of marking sections of text to WORDWISE. This provides a simple and very effective means of moving or copying any section of text to any other position in the document. However INTER-WORD has extended the marked section idea so that it may be centred or underlined or emboldened etc.

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The latest computers make use of menus in the same way as INTER-WORD. There is no need to remember long lists of commands or values which may follow them, all options are shown on the menus.

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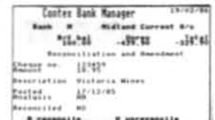

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Copies – relative and absolute

NIGEL PETERS continues his series on spreadsheets by looking at different ways of copying

AS we've seen, spreadsheets consist of a lot of numbers – well-labelled for easy understanding – all interconnected by sets of formulae. We've seen how to enter all three.

For the numbers and labels we want to use in our model we just type in figures or letters. However for formulae we have to warn the micro beforehand, otherwise they're treated as labels. We do this by pressing *f0*, one of the red function keys, before we enter them.

While so far our models have been quite simple and shouldn't be beyond even the most mediocre typist, in real life there's a fair amount of keyboard effort put into a spreadsheet. And a lot of it is repetitive, the same numbers and labels coming up all over the place.

Because of this most spreadsheets have the ability to copy contents from one cell to another. As previously, I'll be using Mini Office II for my examples, but the principles will apply to any spreadsheet worthy of the name.

Copying numbers or labels from one part of the sheet to another is simple. You just move the cursor to the cell you want to copy – making it the active cell – and press the function key *f5*. This tells the micro that it is to take the label or number in that cell and copy it.

But where to? Again the cursor is moved, this time to the cell you want to receive the duplicate. As soon as the cursor is in position and the receiving cell is active a press of the Copy key has the program doing the copying.

Suppose that you've got the figure 5 in cell C5 and you want to have a 5 in cell F7. All you do is move the cursor to C5, press *f5*, move it to F7 and press Copy. The result is that both C5 and F7 now contain 5. The details may vary from spreadsheet to spreadsheet, but the principles of telling the micro what to copy and where to copy it to will be the same.

So now you know how to copy two of the elements of a spreadsheet. But what of the third, the formulae used? Let's see what we can do with these by taking a look at Figure I.

Despite the lack of labels, it shouldn't be too hard to see where the figures come from. Unless things have altered radically since I was at school 1 and 1 make 2, 2 and 2 make 4 and I'm fairly confident that 4 and 4 make 8. Even if I wasn't I could use the spreadsheet to check up.

All right I agree that the example is trivial, but it's useful for the point I'm trying to make. It's obvious that for each row the first two numbers are added and the result placed in the third cell along. Figure II shows the formulae used.

Although the formulae in column C are all made up of different cells they do have something in common. In each case the formula is in effect saying "add together the numbers held in the two cells to my left and put the result in this cell".

In the case of the formulae in C1 the two cells are A1 and B1. For C2 the cells are A2 and B2 and I'll leave you to figure out what cells go together to make up C3.

Now the cells in each formula – and the numbers they contain – are all different, but the way the formulae treats these cells is the same. The cells in row 1 are used in exactly the same relationship as those in rows 2 and 3. The terms used in the formulae vary, but the underlying theme – add the two on the left and stick the result in here – is the same.

I advise you to set up the model shown in Figure II as you'll learn a lot more from doing that than by just reading. I hope that when you enter the numbers in columns A and B you use your new-found skill with the Copy key to ease the typing.

However we're still stuck with typing in the three formulae in column C, the results column. Or are we? Certainly we have to type in the first of the formulae A1+B1 into cell C1, but there's no need to laboriously enter the others. After all, as we've just seen, they're practically the same.

What we need to do is a relative copy. How this is done again depends on the individual spreadsheet, but

```
    .......A .......B .......C .......D
1     1.00     1.00     2.00
2     2.00     2.00     4.00
3     4.00     4.00     8.00
4
5
6
```

Figure I: A simple spreadsheet

```
    .......A .......B .......C .......D
1     1.00     1.00  A1+B1
2     2.00     2.00  A2+B2
3     4.00     4.00  A3+B3
4
5
6
```

Figure II: Simple formulae

From Page 13

they all have this facility. In the case of Mini Office we just do what we did before.

First we move the cursor to the cell with the formula we want to copy. Then we press *f5*, move the cursor to the cell we want to receive the copy of the formula and press Copy.

In the case of Figure II we make C1 the active cell, then press *f5*. Next we move the cursor to the cell we want to copy to, in this case C2. Then we just press Copy and the formula A2+B2 is put into C2.

Of course we don't see A2+B2 in the cell C2 – we see the number produced by the addition of what's in A2 and B2, in this case 4. However the formula appears in the contents section of the status area, explaining how C2 is arrived at. The point to notice is that when we copied C1's formula into C2 we didn't get an exact copy. We copied A1+B1, but got A2+B2.

The spreadsheet takes the relative positions of the cells in the first formula and works out the second formula using cells that correspond to the same positions around the receiving cell. It's easier to see in practice than it is to describe. Try it out for yourself and you'll soon see how simple it is.

Going back to the spreadsheet of Figure II we can copy the formula into C3 where we get A3+B3. Notice that here we could use either C1 or C2 as the root cell for the relative copy operation, and the result is the same – the two cells on the left are added together and the result put in the one on the right.

We could carry on like this down the C column copying one row's formula from the row above until we run out of rows. We can also copy from column to column. To see this, make C1 the active cell, then press *f5*, move the cursor to D1 and press Copy.

The result is that the formula B1+C1 is placed in D1. This makes sense as we've copied the formula that said "add together the two sums on the left" into cell D1. Well the two cells to the left of D1 are C1 and B1, hence the formula that arrives in D1 as a result of the relative copy is B1+C1.

Again it's easier done than said. Try it out on your own spreadsheet and you'll soon have the hang of it. Once you've got the knack you'll find that it makes creating spreadsheets a lot easier. You can test your skills on layouts such as Figure III.

There's no mystery to this spreadsheet, it's just a reference guide to VAT. The first column has the price, the second the VAT it attracts and the third the price including VAT. There's no need to enter eight different formulae in columns B and C. All you have to do is enter A1*0.15 in cell B1 and copy it down the column. Similarly with C1, which contains A1+B1.

Now after holding forth on relative copying I'll admit to having ignored something – when you press *f5* to start the copying process you get the message:

```
Use cursor keys then COPY/RETURN
```

Well we've used the cursor keys to position our copied formula and we've used Copy to transfer it. So what's Return used for? The answer is that it is used when we want a different kind of copying.

Suppose that somewhere in your spreadsheet you'd tucked away the formula A1+B1/4 in a handy cell, say C1. Later you want the exact same formula in another cell, say E7. How would you do it? If you try and use *f5* with the Copy key what you get for your pains is C7+D7/4 in E7, which is a relative copy.

Now relative copies are good things otherwise I wouldn't have talked about them, but that wasn't what was wanted. We wanted to take the formula in C1 and have a copy of it in E7 unchanged. What we need is a way of making an absolute copy, and this is where the Return key comes in.

To make an absolute copy of a formula with Mini Office all we do is follow the procedure as before, but press Return instead of Copy. What happens next is

```
      .......A .......B .......C .......D
  1     10.00      1.50    11.50
  2     15.00      2.25    17.25
  3     20.00      3.00    23.00
  4     30.00      4.50    34.50
  5
  6
```

Figure III: VAT at standard rate

```
      .......A .......B .......C .......D
  1      1.00      1.00     2.00
  2      2.00      2.00     2.00
  3      4.00      4.00     2.00
  4
  5
  6
```

Figure IV: Absolute copying

```
      .......A .......B .......C .......D
  1     Rate      0.15
  2
  3     10.00   A3*B1   A3+B3
  4     15.00   A4*B1   A4+B4
  5     20.00   A5*B1   A5+B5
  6     30.00   A6*B1   A6+B6
  7
  8 Formulae when B1 holds VAT rate
```

Figure V: Formula map for VAT

that the status area puts up a message:

`Absolute or Relative`

and you have to press A for absolute or R for relative for each element in the formula. The program prompts you for each bit of it, but this is not needed, as the formula is there in the first cell to guide you.

Ignoring the R option, we'll concentrate on the A and use it to produce the spreadsheet in Figure IV.

Columns A and B are as before, just containing numbers. Enter them into your spreadsheet. Column C contains the formulae. Put the familiar formula A1+B1 into cell C1. Now copy it into cell C2, but this time instead of pressing Copy press Return. The result is the:

‘A little time, trouble and forethought in creating a spreadsheet can pay rewards in its ease of use’

`Absolute or Relative`

query in the status area. Pressing A twice – once for the A1 part and once for the B1 – results in the formula A1+B1 appearing in cell C2. Try the same technique to get A1+B1 into C3. Remember for absolute copying you use Return and press A for the elements to be copied unchanged. Practice will bring confidence. Honest.

While relative copying is very useful, in practice absolute copying is rarely used unmodified. What's more usual is a mix of both. Figure V shows the formula map of a spreadsheet which has this mix.

It's our VAT table again, only it's been revamped. Now the VAT rate is held in B1 (and labelled – wonders never cease). Then this value is used in the formulae in column B and column C adds the figures from A and B.

Let's look at how we'd enter the formula. Column C is no problem. We just enter A3+B3 in cell C3 and then use *f5* and Copy to duplicate the formulae in column C. That's our old friend, relative copying. The formulae in column B are another matter.

Here we want the best of both worlds. The A3 bit of the original formula wants to be duplicated relatively giving A4, A5 and so on. However we don't want the B1 part to be affected. It has to stay B1 all the way through, so we want a mix of relative and absolute copying.

To do this we follow the same procedure as before, and use Return rather than Copy. Now we're faced with the:

`Absolute or Relative`

message again, and for each element of the expression we want copied we choose A for absolute or R for relative.

To see this in practice enter A3*B1 into cell B3. To produce the required formula in C4 we move the cursor to cell C3, press *f5* and then move it to C4, making that active. Now Return is pressed and the A or R options come up. As we want the first part to be copied relatively we press R, giving the needed A4.

We want the second part of the formula – B1 – to stay the same, so we choose the A option to ensure that element is copied exactly. This puts A4*B1 in B4. The same process is followed for B5 and B6. Figure VI shows the result.

You may be wondering why I put the VAT rate up in B1 when this makes the copying difficult. Well imagine that the VAT rate changed from 15 per cent to 20 per cent. Reflecting this in the spreadsheet of Figure III would be quite difficult.

Still, with this latest model all we have to do is change the value in B1 and watch the effects ripple through as shown in Figure VII.

As you can see, a little time, trouble and forethought in creating a spreadsheet can pay rewards in its ease of use. That's where we'll end for now. Have a go at all the methods of copying we've covered.

- *Whatever spreadsheet you have you'll find similar features for replicating formulae as they are known. Next month we'll be looking at what formulae we can actually construct.*

	.......A	.......B	C	.......D
1	Rate	0.15	11.50	
2				
3	10.00	1.50	11.50	
4	15.00	2.25	17.25	
5	20.00	3.00	23.00	
6	30.00	4.50	34.50	
7				
8	Formulae when B1 holds VAT rate			

Figure VI: VAT again

	.......A	.......B	C	.......D
1	Rate	0.20		
2				
3	10.00	2.00	12.00	
4	15.00	3.00	18.00	
5	20.00	4.00	24.00	
6	30.00	6.00	36.00	
7				
8	Formulae when B1 holds VAT rate			

Figure VII: VAT increased

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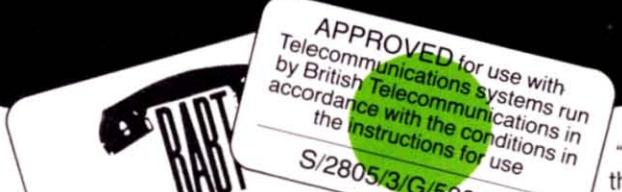
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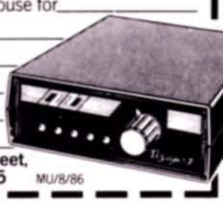

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